(*)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.
O07G410V01101	Matemáticas: Cálculo I	1st	6
O07G410V01102	Matemáticas: Álxebra lineal	1st	6
O07G410V01103	Física: Física I	1st	6
O07G410V01104	Informática: Informática	1st	6
O07G410V01105	Expresión gráfica: Expresión gráfica	1st	6
O07G410V01201	Matemáticas: Cálculo II	2nd	6
O07G410V01202	Física: Física II	2nd	6
O07G410V01203	Química: Química	2nd	6
O07G410V01204	Empresa: Administración da tecnoloxía e a empresa	2nd	6
O07G410V01205	Tecnoloxía aeroespacial	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
O07G410V01301	Matemáticas: Métodos matemáticos	1st	6
O07G410V01302	Enxeñaría eléctrica	1st	6
O07G410V01303	Termodinámica	1st	6
O07G410V01304	Ciencia e tecnoloxía dos materiais	1st	6
O07G410V01305	Mecánica clásica	1st	6
O07G410V01401	Matemáticas: Estatística	2nd	6
O07G410V01402	Mecánica de fluídos	2nd	6
O07G410V01403	Electrónica e automática	2nd	6
O07G410V01404	Transporte aéreo e sistemas embarcados	2nd	6
O07G410V01405	Resistencia de materiais e elasticidade	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
O07G410V01501	Fabricación aeroespacial	1st	6

Year 4th

Code	Name	Quadmester	Total Cr.
O07G410V01701	Dirección e xestión de proxectos	1st	6
O07G410V01901	Sistemas de navegación	2nd	6
O07G410V01902	MEF dinámicos e vibracións	2nd	6
O07G410V01903	Materiais para a industria aeroespacial	2nd	6
O07G410V01904	Sistemas en tempo real	2nd	6
O07G410V01905	Meteoroloxía	2nd	6
O07G410V01906	Avións non tripulados	2nd	6
O07G410V01907	Radar	2nd	6
O07G410V01908	Fundamentos do láser para tecnoloxías aeroespaciais	2nd	6
O07G410V01909	Tecnoloxías da información e as comunicacións	2nd	6
O07G410V01910	Sistemas da xestión da información	2nd	6
O07G410V01911	Sistemas de comunicacións avanzados en vehículos aeroespaciais	2nd	6
O07G410V01912	Sistemas aplicados ao deseño aeroespacial	2nd	6
O07G410V01913	Tecnoloxías para conformado de materiais aeroespaciais	2nd	6
O07G410V01914	Cartografía e xeodesia	2nd	6
O07G410V01915	Aplicacións dos microcontroladores en sistemas aeroespaciais	2nd	6

O07G410V01916	Instrumentación electrónica empotrada	2nd	6

Year 3rd			
Code	Name	Quadmester	Total Cr.
O07G410V01921	Mecánica de sólidos e estruturas aeronáuticas	1st	9
O07G410V01922	Mecánica de fluídos II e CFD	1st	9
O07G410V01923	Aerodinámica e aeroelasticidade	2nd	9

Year 4th			
Code	Name	Quadmester	Total Cr.
O07G410V01924	Mecánica do voo	1st	6

Year 3rd			
Code	Name	Quadmester	Total Cr.
O07G410V01925	Enxeñaría de sistemas e comunicacións aeroespaciais	2nd	6
O07G410V01931	Aerorreactores e motores alternativos aeronáuticos	1st	6
O07G410V01932	Deseño mecánico, MEF e vibracións	2nd	9
O07G410V01933	Vehículos espaciais	2nd	6

Year 4th			
Code	Name	Quadmester	Total Cr.
O07G410V01934	Aeronaves de á fixa e rotatoria	1st	9
O07G410V01935	Mantemento e certificación de vehículos aeroespaciais	1st	9

Year 3rd			
Code	Name	Quadmester	Total Cr.
O07G410V01941	Cálculo numérico	1st	6
O07G410V01942	Aleacións e materiais compostos aeroespaciais	2nd	9
O07G410V01943	Mecánica analítica e orbital	2nd	6

Year 4th			
Code	Name	Quadmester	Total Cr.
O07G410V01944	Control e optimización	1st	6
O07G410V01945	Sistemas de propulsión	1st	6
O07G410V01946	Vehículos aeroespaciais	1st	6
O07G410V01981	Prácticas en empresas	2nd	6
O07G410V01991	Traballo de Fin de Grao	2nd	12

IDENTIFYING DATA				
Mathematics: Calculus I				
Subject	Mathematics: Calculus I			
Code	O07G410V01101			
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 lenguage	• 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

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 lenguage	• 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	Qualification	Evaluated Competencess

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>=2,5
    - (P1 + P2)/2>=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 x (P1 + P2)/2+0.2 x 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 x P+0.2 x 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	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. 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. 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? 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. 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
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 lenguage	• 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 inertia - Newton's second law weight - Newton's third law 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 Competencess
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
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. ; Elíiot 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 lenguage	• 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 Competencess
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,
Guttag, 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	The main objective of this subject is to train students in the handling and explotation 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. 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, sinthesys and visualization (abstraction and idealization), as well as the utilization of the graphic language. Normalization is necessary for exhaustive definition of forms, components, objects, mechanisms or installations, in respective projects, it requieres knowledge of basic rules on formats, lines, ways of representation, dimensioning, symbology or geometrical product specifications (GPS). 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 differents files or the parametric dimensioning, complete this approach.			

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	Capabiliity 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 lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT6	Capabiliity for interpersonal communication	• Know How • Know be
CT8	Capabiliity 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. - Development of capacities for abstraction and idealization. - Knowledge of general principles for geometrical design. - Knowledge of the main tools and techniques of representation.	CB1 CE5 CT1 CT3 CT4 CT6 CT8

Contents

Topic	
THEORY	.

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

2- Common practics	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, assambly 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 Competencess
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 Indiustrial, 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 lenguage	• 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 Competencess
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 lenguage	• 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	Capabiliity 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 Competencess
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 presentationabout the activities realized at the laboratory. The students that do not attend the laboratory will be specifically evaluated abut 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

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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 suas unidades, y da sua 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 naturaleza 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	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	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	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	4.1 Ions 4.2 Sólidos iónicos: natureza 4.3 Enerxía de rede 4.4 Propiedades dos sólidos iónicos
TEMA 5. ENLACE METÁLICO	5.1 Sólidos metálicos 5.2 Enlace metálico
TEMA 6. INTERACCIÓNS INTERMOLECULARES	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	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	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 quìmicas
TEMA 9. EQUILIBRIO QUÍMICO	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	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	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	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	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	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

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 maxistrais, 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 Competencess
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 magistrais, 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 traverso 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 magistrais, 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 calificaciòn 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

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 obxetivo 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 simultáneamente: 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) Datas 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

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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 Sellero, Francisco Javier			
Lecturers	Sánchez Sellero, 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 interpersoal	• 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 Competencess
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

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

Fernandez Sanchez, Esteban, Administración de Empresas, 2010, Paraninfo

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	O07G410V01205			
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, maniobrabilidad 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	- Introdución 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	- 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	- Clasificación de vehículos aeroespaciais - Aerostatos e aerodinos - Vehículos espaciais - Aeronaves de á rotativa
Arquitectura do avión	- Partes do avión - Materiais - Procesos de fabricación
Aerodinámica de perfís	- Orixe das cargas aerodinámicas - Perfís aerodinámicos - Curvas características - Entrada en perda de perfís - Perfís en réxime compresible
Actuacións do avión	- 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	- Introdución á propulsión - Propulsión a hélice - Propulsión a chorro
Instrumentos das aeronaves	- Instrumentos de voo e navegación - Instrumentos da planta propulsora - Agrupamento dos instrumentos

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	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 introdutorias	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 Competencess
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

Other comments on the Evaluation

Estudantes 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: Álxebra lineal/O07G410V01102
Matemáticas: Cálculo I/O07G410V01101

IDENTIFYING DATA

Mathematics: Mathematical methods

Subject	Mathematics: Mathematical methods			
Code	O07G410V01301			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this subject is that the students know and master the basic techniques of the complex variable and its applications, the partial differential equations and their applications; necessary both for other subjects of the degree and for professional practice. 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
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
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 lenguage	• 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
LO1: Knowledge and understanding of the basic technicians of Complex Variable that are of application in the field of the Aerospace Engineering.	CG2 CE32 CT1 CT3 CT4 CT5 CT6 CT8
LO2: Understanding the basic models that, in the form of partial differential equations are applicable in Aerospace Engineering. Knowledge and application of the methods of basic resolution for this type of models.	CG2 CE32 CT1 CT3 CT4 CT5 CT6 CT8

Contents	
Topic	
Complex variable	1. Analytical functions. 2. Integration in the complex field. 3. Series. 4. Residues and poles. 5. Z transform.
Series of Fourier	
Partial differential equations	1. Introduction. 2. The potential equation. 3. The heat equation. 4. The wave equation.
Integral transforms	1. Fourier transform. 2. Laplace transform. 3. Resolution of partial differential equations by means of integral transform.

Planning	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	29	60	89
Problem solving	15	15	30
Autonomous problem solving	0	17.5	17.5
Computer practices	5	5	10
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 directed to take contact and gather information on the students, as well as to present the subject.
Lecturing	The professor will expose in the theoretical classes the contents of the matter that illustrate with numerous examples and applications. The students will have basic texts of reference for the follow-up of the subject
Problem solving	Approach, analysis, resolution and debate of a problem or exercise related with the matter given, so much by part of the educational as of the students. To illustrate and complete the explanation of each lesson and to help to that the student purchase the necessary capacities.
Autonomous problem solving	The student will have to resolve similar exercises to the realised in class to purchase the necessary capacities.
Computer practices	The student will use computer tools to resolve problems and exercises and apply the knowledges obtained in the classes of theory, and the student will have to resolve similar exercises to purchase the necessary capacities.

Personalized assistance	
Methodologies	Description
Lecturing	The professor will attend personally the doubts and queries of the studentes. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.
Problem solving	The professor will attend personally the doubts and queries of the studentes. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.
Autonomous problem solving	The professor will attend personally the doubts and queries of the students. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.

Assessment		
Description	Qualification	Evaluated Competencess

Problem solving	Realization in an autonomous way of a collection of problems of each block of content. LO1, LO2	40	CG2 CE32 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	Realization of a final exam in which they collect the corresponding contents to the master sessions and to the resolution of problems. LO1, LO2	60	CG2 CE32 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

In any call it is necessary to obtain 5 points to pass the subject. The maximum duration of any exam will be 3 hours. Since the subject has two distinct 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 certificate will be the sum of both notes limiting it to a maximum of 4.8 points. (*)

Evaluation June-July (attendees):

An examination will be carried out to assess the learning outcomes and the achievement of the competences indicated in the teacher's guide. This exam will provide 100% of the rating of this call.

In the case of having obtained a minimum of 3.5 points in one part (and not having reached 2 points in the other part), the student can choose to perform only the suspended part or the complete exam. The criterion indicated in (*) will also apply.

Procedure of evaluation for non-attendees (December-January and June- July):

An examination will be carried out to assess the learning outcomes and the achievement of the competences indicated in the teacher's guide. This exam will provide 100% of the rating of this call. The criterion indicated in (*) will also apply.

Evaluation dates:

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

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

Churchill, Churchill, R.V.; Brown, J.W., Variable Compleja y Aplicaciones, Mc Graw-Hill, 1991,

Haberman, R., Ecuaciones en derivadas parciales con series de Fourier y problemas de contorno, Prentice Hall, 2003,

Marcellán, F.; Casasús, L.; Zarzo, A., Ecuaciones diferenciales. Problemas lineales y aplicaciones, Mc Graw-Hill, 1991,

Pestana, D., Rodríguez J.M.; Marcellán, F., Variable compleja. Un curso práctico, Síntesis, 1999,

Zill, D.G.; Cullen, M.R., Matemáticas avanzadas para Ingeniería 2. Cálculo vectorial, análisis de Fourier y análisis complejo, Mc Graw-Hill, 2008,

Complementary Bibliography

Carrier, G.F., Partial differential equations: theory and technique, Academic Press, 1988,

Farlow, S.J., Partial differential equations for scientists & engineers, John Wiley & Sons, 1993,

Gómez López, M.; Cordero Gracia, M., Variable compleja. 50 problemas útiles, García-Maroto, 2012,

Parra Fabián, I.E., Ecuaciones en derivadas parciales. 50 problemas útiles, García-Maroto, 2007,

Stephenson, G., Introducción a las ecuaciones en derivadas parciales, Reverté, 1982,

Weinberger, H.F., Ecuaciones en derivadas parciales, Reverté, 1996,

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201

Other comments

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

IDENTIFYING DATA				
Electrical engineering				
Subject	Electrical engineering			
Code	O07G410V01302			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Albo López, Ana Belén			
Lecturers	Albo López, Ana Belén			
E-mail	aalbo@uvigo.es			
Web	http://aero.uvigo.es			
General description	The objectives pursued with this subject are: - Acquisition of knowledge related to symbols, magnitudes, principles, basic elements and laws of electricity. - Knowledge of techniques and methods of circuit analysis in sinusoidal steady-state. - Description of three-phase systems. - Knowledge of the operating principles and characteristics of the different electrical machines. - Basic knowledge of electrical installations and systems.			

Competencies		
Code		Typology
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How • Know be
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How • Know be
CE17	Appropriate knowledge applied to engineering: Fundamental elements of the differente types of aircrafts; the functional elements of air navigation systems and associated electrical and electronic installations; foundations of the design and construction of airports.	• know • Know How
CT1	Capability of analysis, organization and planification.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How • Know be
CT5	Capability to solve problems and draw decisions	• know • Know How • Know be
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• know

Learning outcomes	
Learning outcomes	Competences
Capacity to analyse electrical circuits and its application in the resolution of real problems	CG1 CG4 CE17 CT1 CT3 CT4 CT5 CT6 CT8 CT13

Basic knowledge of electrical machines and their utilization	CG1 CG4 CE17 CT1 CT3 CT4 CT5 CT6 CT8 CT13
Capacity to design and calculate basic electrical installations	CG1 CG4 CE17 CT1 CT3 CT4 CT5 CT6 CT8 CT13

Contents	
Topic	
Topic I: Introduction.	Active and passive elements of the electrical circuits.
Topic II: Alternating current circuits: single-phase and three-phases	Waveforms. Behavior of the elements in alternating current. Ideal and real elements. Combinations of elements. Kirchhoff's laws. Substitution, superposition, Thevenin and Norton Theorems. Complex, apparent, active and reactivates powers. Boucherot Theorem. Balanced three-phase system: values of line and phase, reduction to the equivalent single-phase circuit.
Topic III: Basics of Electrical Machines	Single-phase and three-phase transformers: constitution, in no-load operation and in load, equivalent circuit and time index. Asynchronous machines: constitution, generation of the rotating field, in no-load operation and in load, equivalent circuit, characteristic curves, maneuvers. Synchronous machines: constitution, equivalent circuit, in no-load operation and in load, synchronization. Direct current machines: constitution, generalities, curves characteristics.
Topic IV: Basics of Electrical Installations	Introduction to electrical power systems. Introduction to aeronautical electrical installations. Basic electrical installations: Constitutive elements. Workload Estimate. Introduction to the installation calculation
Practices	- Laboratory Safety Standards. - Direct current: Association of elements - Alternating Current: Visualization and measurement of sine waves. Connection series - parallel. Balanced three-phase system. - Electrical Machines: Tests on motors and / or transformers.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Problem solving	20	20	40
Autonomous problem solving	0	27	27
Laboratory practical	10	10	20
Essay questions exam	3	0	3

*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 expose in the classes of large groups the contents of the matter.
Problem solving	Problems and type exercises will be exposed and solved in the classes of large groups as a guide for the students.
Autonomous problem solving	It is highly advisable that the student try to solve exercises and issues of the subject proposed by the professor.

Laboratory practical	Practical assemblies corresponding to the contents seen in the classroom will be made in the laboratory, or complementary aspects not treated in the theoretical classes will be treated.

Personalized assistance

Methodologies	Description
Lecturing	The professor will personally attend the doubts and queries of the students.
Problem solving	The professor will personally attend the doubts and queries of the students.
Laboratory practical	The professor will personally attend the doubts and queries of the students.
Autonomous problem solving	The student will be able to attend tutorials to resolve any question related to the proposed problems.

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	The fulfillment of the practices and the resolution of a questionnaire regarding the assembly, results obtained and interpretation of the same, will be valued positively. The fulfillment of each practice and presentation of the internship report will value between 0 and 10 points. For that it is essential to attend the practice the day and time set at the beginning of the course. There will be no recovery of practices. The evaluation of the set of practices is the arithmetic mean of the obtained scores. The non-presentation of a report of practices, will take the note of zero points in it. The deadline for the presentation of each practice will be established once it has been made.	20	CE17 CT1 CT3 CT4 CT5 CT6 CT8
Autonomous problem solving	Written tests and / or works will be carried out to evaluate the resolution of autonomous problems, throughout the teaching period.	10	CG1 CE17 CT1 CT4 CT5 CT8
Essay questions exam	There will be a general examination with two sections, one corresponding to the contents of circuit theory and the other corresponding to machines and electrical installations, which may include both theoretical and application exercises. Each section will be valued from 0 to 10 points. The final qualification of this examination will be calculated using the arithmetic mean of both sections, although a minimum of a 3 in each of the parts will be required to overcome the matter. A partial examination, corresponding to the part of Theory of Circuits (Topics II of the section of Contents), will also be carried out. To pass this partial exam, the grade obtained will be equal or higher than 5 points out of 10, and they will have two options to introduce themselves to final exam: - Only the second section: electrical machines and installations (Topic III and IV of the section of Contents). In this case the partial exam qualification will be retained. - Doing the complete exam (two sections), if wanting to improve the grade in the first section. In this case, the score will correspond to the obtained in each of the sections of the complete examination, not keeping the partial exam qualification. In case the partial examination is not carried out or the student does not pass it, directly apply paragraphs 1 and 2 of this same section (examination general).	70	CG1 CG4 CE17 CT1 CT3 CT4 CT5 CT8 CT13

Other comments on the Evaluation

The **calendar of the evaluation tests** is published in the webpage http://aero.uvigo.es/gl/docencia/exames.

It is considered by default that students will course the matter through the **on-site modality**. In case of students who want to take advantage of the out-site modality, due to facts such as job responsibilities or others in similar circumstances, they should contact the person in charge of the matter. These students will have to adduce reasonable and proven causes for

such a decision and they will be addressed, in each case, how they will take the course and do the examinations on the "laboratory practices" and "resolution of autonomous problems" methodology. The rest of the evaluation will be the same as the on-site students.

The **final qualification** is calculated by means of the weighted average of the previous items.

Qualification = 0.10 x Resolution of autonomous problems + 0.20 x Practices + 0.70 x Examination

If a grade of 3 or lower is achieved in some parts of the general exam, and even if the global grade achieved is higher than 4.5, the maximum grade obtained will be 4.5.

The assistance to the practices and the resolution of autonomous problems are **continuous evaluation activities**.

The professor of this matter will allow the students to take a final exam in order to reach better qualifications, so those students willing to **improve their continuous evaluation qualifications** should take an **additional exam** following the general exam, which will include questions related to the contents of the teaching in "laboratory practices" and "resolution of autonomous problems", evaluable for 0 to 10, and that may even be the 30% of the final qualification. In such case, the qualification to be taken into account to assess the continuous evaluation activities will be the obtained in the additional exam.

For the **June-July second opportunity**, the last qualification in the **continuous evaluation** obtained during the course is kept, i.e. either the one obtained by means of the regular activities, or the one from the additional exam if done, without prejudice that (as in the December first opportunity) it can be surpassed for the passing of an additional exam. In this case, the qualification to take into account to assess the continuous evaluation activities will be the achieved in the last qualification.

Regarding the **qualifications obtained in the partial examination or in the December final examination**, the qualification of the section passed will be kept, until the June-July exam, if a score of 5 points out of 10 is achieved. Then, the student may:

- Only to the section not passed. In this case, the note of the section already passed will be retained.

- Doing the complete exam (two sections), of wanting to improve a qualification in the section already passed previously. In this case, the score will correspond to that obtained in each of the sections of the complete exam, not keeping the note of the section exceeded.

Each **new registration** in the matter **supposes a zeroing** of all the qualifications obtained in previous courses.

According to School normative: **The maximum duration of an exam** will be 3 hours if there is no break or 5 hours if there is an intermediate break (3 hours being the maximum for each part). So:

- the maximum duration of the general examination will be 3 hours (corresponding to 1.5 hours each section)

- if the student takes the additional exam corresponding to the continuous assessment part, it will be done once the exam is finished, after a break, and its maximum duration will be 1.5 hours.

Sources of information

Basic Bibliography

V. M. Parra, A. Pérez, A. Pastor, J. Ortega, TEORÍA DE CIRCUITOS Vol. 1 y 2, UNED, 2003,

Suarez Creo J. y Miranda Blanco B.N., MÁQUINAS ELÉCTRICAS. FUNCIONAMIENTO EN RÉGIMEN PERMANENTE, 4ª, Editorial Tórculo, 2006,

M. Plaza Fernández, Electricidad en los aviones: Generación, utilización y distribución de energía eléctrica, 6ª, Ediciones Paraninfo, 1981,

R. Sanjurjo Navarro, Sistemas eléctricos en aeropuertos, AENA, 2004,

Complementary Bibliography

F. Barrero, Sistemas de Energía Eléctrica, Thomson, 2004,

R. Sanjurjo, E. Lázaro, El sistema eléctrico en los aviones, AENA, 2001,

Jesús Fraile Mora, Circuitos eléctricos, Prentice Hall, 2015,

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematical methods/O07G410V01301

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201

IDENTIFYING DATA				
Thermodynamics				
Subject	Thermodynamics			
Code	O07G410V01303			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Cerdeiriña Álvarez, Claudio			
Lecturers	Cerdeiriña Álvarez, Claudio Troncoso Casares, Jacobo Antonio			
E-mail	calvarez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Students will be instructed on the concepts, Laws, and main applications of the basic science of Thermodynamics.			

Competencies		
Code		Typology
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 • Know be
CE8	Understand thermodynamic cycles generating mechanical power and thrust.	• know • Know How
CE16	Appropriate knowledge applied to engineering: Concepts and laws that govern the processes of transfer of energy, the movement of fluids, the mechanisms of transmission of heat and the interchange of matter and its role in the analysis of the main propulsion systems in aerospace engineering.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How
CT1	Capability of analysis, organization and planification.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How • Know be
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How • Know be
CT6	Capabiliity for interpersonal communication	• know • Know be
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How

Learning outcomes	
Learning outcomes	Competences
Knowledge, comprehension, application, analysis and synthesis of the principles and methods of Thermodynamics.	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Knowledge and comprehension of the first and second laws of Thermodynamics and their applications to open systems, with illustration for some typical examples in Aerospace Engineering.	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Knowledge, comprehension and application of the generalized thermodynamic relations, the equilibrium and stability contitions of simple compressible systems and phase transitions.	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Contents

Topic	
First law.	Energy and temperature. Thermodynamic processes and reversibility. Pressure-volume work. Adiabatic work and heat. Equation of state and volumetric coefficients. Heat capacity. Thermodynamic relations in pVT systems from isochoric, isobaric, isothermal and adiabatic processes. Appendix 1.1. Heat transfer.
Second law.	Interconversion of heat and work. Carnot cycle and absolute temperature. Entropy. Irreversibility, law of entropy increase and extremal principle.
Thermodynamic potentials and formal structure.	Thermodynamic potentials, extensivity and concavity. Euler equation and Gibbs-Duhem equation. Legendre transforms. Extremal principle for F and G. Extremal principle for U, concavity, convexity and second derivatives. Maxwell relations and Gibbs-Helmholtz equations. Appendix 3.1. Real gases. Appendix 3.2. Elasticity. Appendix 3.3. Surface thermodynamics.
Phase transitions.	Phase rule. Phase diagrams. Clapeyron equations. Liquid-gas transition in the van der Waals model. Second-order transitions. Third law.
Thermofluidics.	Control volumes. Conservation of mass. Work flux and energy in a fluid in motion. Analysis of energy of systems of stationary flux. Engineering devices of stationary flux.
Laboratory	Itinerary "Equation of State": Ideal gas; Adiabatic coefficient; Joule-Thomson effect. Itinerary "Phase transitions": Liquid-vapor equilibrium; Critical point; Ferromagnetism. Itinerary "Miscellaneous": Specific heat of solids; Engines; Stefan-Boltzmann law.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	19	43.5	62.5
Seminars	20	44	64
Laboratory practical	11	10	21
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 most relevant parts of the course shall be taught in one-hour sessions. Active participation of students will be welcome.
Seminars	Every hour will be devoted to supplement Master Sessions as well as to the resolution of exercises. Active participation of students will be welcome.
Laboratory practical	Once assessment of parts devoted to theory and exercises is finished, students will enter the laboratory under the teacher's supervision. Student's autonomy will be encouraged.

Personalized assistance

Methodologies	Description
Laboratory practical	Performance of each student will be supervised.

Assessment

	Description	Qualification	Evaluated Competencess
Lecturing	Jointly with that relative to Seminars, an exam will be held during classes, which will carry exemption for those students getting a qualification greater than 7 points (over 10).	20	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Seminars	Jointly with that relative to Master Sessions, an exam will be held during classes, which will carry exemption for those students getting a qualification greater than 7 points (over 10).	20	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Laboratory practical	Assessment will be made in January, in the laboratory and via an exam.	10	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	An exam for the whole course contents will be held on the official date.	50	CG2 CE8 CE16 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

To go further in December/January, a qualification greater than 5 (over 10) will be required. This corresponds to the joint assessment of the official exam and the exam during classes. Secondly, a qualification greater than 5 (over 10) will also be required for the laboratory part. These thresholds being overcome, the final qualification will be obtained according to the balance indicated above.

To go further in June/July, a qualification greater than 5 (over 10) in an exam over the whole course contents (theory, exercises and laboratory) will be required. That exam will be held on the official date.
The June/July criterion applies to any student that do not take classes regularly.
The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

Sources of information

Basic Bibliography

J. F. Tester, M. Modell, Thermodynamics and Its Applications, 3ª ed., Prentice Hall, 1996, Upper Saddle River, New Jersey

M. Alonso, E. J. Finn, Física, Addison-Wesley Iberoamericana, 1992, Buenos Aires

H. B. Callen, Termodinámica, 1ª ed., Editorial AC, 1981, Madrid

H. B. Callen, Thermodynamics and an Introduction to Thermostatistics, 2ª ed., John Wiley & Sons, 1985, New York

L. I. Sedov, Mechanics of Continuous Media, World Scientific, 1997, London

Y. A. Cengel, M. A. Boles, Termodinámica, 8ª edición, McGraw-Hill, 2015, México

Complementary Bibliography

D. Kondepudi, I. Prigogine, Modern Thermodynamics, John Wiley & Sons, 1998, New York

B. Widom, Thermodynamics - Equilibrium, Encyclopedia of Applied Physics, Vol. 21, Wiley, 1997, New York

Recommendations

Subjects that continue the syllabus

Fluid mechanics/O07G410V01402

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103

IDENTIFYING DATA				
Ciencia e tecnoloxía dos materiais				
Subject	Ciencia e tecnoloxía dos materiais			
Code	O07G410V01304			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Guitián Saco, María Beatriz			
Lecturers	Guitián Saco, María Beatriz			
E-mail	bea.guitian@uvigo.es			
Web	http://dept05.webs.uvigo.es/			
General description	Esta materia é unha introdución á ciencia dos materiais. O obxectivo é ofrecer ao alumno unha visión xeral dos distintos tipos de materiais, as súas propiedades e aplicacións fundamentais.			

Competencias		
Code		Typology
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 • saber facer
CE11	Comprender as prestacións tecnolóxicas, as técnicas de optimización dos materiais e a modificación das súas propiedades mediante tratamentos.	• 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 • saber facer
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 • saber facer
CT1	Capacidade de análise, organización e planificación	• saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber facer • Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber facer • Saber estar / ser
CT5	Capacidade de resolución de problemas e toma de decisións	• saber facer
CT6	Capacidade de comunicación interpersoal	• saber facer • Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• saber facer
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• saber • saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences
RA1: Coñecemento, comprensión, aplicación e análise das propiedades, transformacións e tratamentos dos materiais e a súa aplicación en enxeñaría especialmente no ámbito Aeroespacial.	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13

RA2: Coñecemento xeral dos distintos materiais metálicos utilizados na enxeñaría, como son os aceiros e as aliaxes lixeiras.	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13
RA3: Coñecemento xeral dos distintos materiais non metálicos utilizados na enxeñaría, como son os materiais poliméricos, os materiais cerámicos, os materiais compostos, etc.	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13

Contidos	
Topic	
Tema 1.Introdución	Introdución a la ciencia de los materiales. Relación entre estructura y propiedades de los materiales. Tipos de materiales.
Tema 2. Estrutura cristalina	Materiais cristalinos e non cristalinos. Estruturas cristalinas. Celas unitarias. Sistemas cristalinos. Anisotropía. Direccións cristalográficas. Planos cristalográficos.
Tema 3. Defectos, deformación plástica e endurecemento dos materiais metálicos	Defectos puntuais: vacantes e impurezas. Difusión. Mecanismos de difusión. Difusión en estado estacionario. Difusión en estado non estacionario. Leis de Fick. Factores da difusión.Defectos lineais: dislocaciones. Dislocaciones e deformación plástica. Deformación por maclado. Endurecemento por acritude. Endurecemento por redución do tamaño de gran. Endurecemento por solución sólida. Defectos interfaciales: límite de gran. Defectos volumétricos.
Tema 4. Diagramas de fase	Solidificación. Nucleación homoxénea e heteroxénea. Crecemento. Curva de enfrimiento. Estrutura de lingote. Defectos de solidificación. Diagramas de fase. Definicións e conceptos fundamentais. Sistemas isomorfos. Sistemas eutécticos. Interpretación de diagramas de fase. Desenvolvemento de microestructuras. Fases intermedias. Reaccións peritéctica e eutectoide. Diagrama Fe-C
Tema 5. Transformacións de fase	Cinética das transformacións de fase. Cambios na microestructura e nas propiedades das aliaxes Fe-C
Tema 6. Propiedades mecánicas básicas	Conceptos de esforzo e deformación. Deformación elástica. Deformación plástica. Ensaio de tracción. Ensaio de dureza. Rotura. Fractura dúctil e fráxil. Principios de mecánica da fractura. Ensaio de tenacidade.
Tema 7. Comportamento a fatiga e a fluencia dos materiais metálicos.	Fatiga. Curva S-N. Factores que afectan a vida a fatiga. Fluencia. Efectos do esforzo e a temperatura. Aliaxes para uso a altas temperaturas.
Tema 8. Aceiros e os seus tratamentos térmicos	Aliaxes férreas: aceiros e fundicións.Tratamentos térmicos.
Tema 9. Aliaxes lixeiras e os seus tratamentos térmicos	Aliaxes lixeiras. Aliaxes de Aluminio. Tipos e nomenclatura. Endurecemento por precipitación.
Tema 10. Materiais poliméricos: cristalinidade, transicións térmicas e comportamento mecánico.	Tipos de polímeros. Cristalinidade. Comportamento térmico: fusión e transición vítrea. Comportamento mecánico: viscoelasticidade. Conformado.
Tema 11. Polímeros termoplásticos, elastómeros e termoestables. Adhesivos.	Características e aplicacións.
Tema 12. Materiais cerámicos	Silicatos. Comportamento tensión-deformación. Refractarios. Abrasivos. Cerámicas avanzadas. Vidros. Vitrocerámicas. Conformación e procesado de cerámicas.
Tema 13. Materiais compostos	Materiais compostos reforzados con fibras. Preimpregnados. Procesado de materiais compostos.

Planificación docente			
	Class hours	Hours outside the classroom	Total hours

Actividades introdutorias	1	0	1
Lección maxistral	23	57.5	80.5
Resolución de problemas	8	16	24
Estudo de casos	9	11.7	20.7
Obradoiro	6	7.8	13.8
Resolución de problemas e/ou exercicios	3	4.5	7.5
Exame de preguntas obxectivas	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.

Metodoloxía docente

	Description
Actividades introdutorias	Presentación da materia. Introdución á ciencia e enxeñaría de materiais
Lección maxistral	Exposición por parte do profesor dos contidos da materia
Resolución de problemas	Resolución de problemas e exercicios relacionados co contido da materia. O alumno deberá ser capaz de resolver problemas de forma autónoma.
Estudo de casos	Análise e resolución de casos prácticos. Os casos poderanse estudar de maneira autónoma ou de maneira conxunta e guiada polo profesor.
Obradoiro	Estudo, mediante exemplos prácticos, do comportamento mecánico dos materiais.

Atención personalizada

Methodologies	Description
Lección maxistral	Tempo que o profesor reserva para atender e resolver dúbidas ao alumnado en relación a aspectos da materia. Pode desenvolverse de forma individual ou en pequenos grupos, sempre coa finalidade de atender as necesidades e consultas do alumnado relacionadas co estudo e/ou temas vinculados coa materia, proporcionándolle orientación, apoio e motivación no proceso de aprendizaxe. Esta actividade desenvolverase fundamentalmente de maneira directa na aula e nos momentos que o profesor ten asignados ás tutorías de despacho, aínda que de forma puntual pode levar a cabo de forma non presencial (a través do correo electrónico ou do campus virtual). O profesorado informará o horario dispoñible na presentación da materia.
Resolución de problemas	Tempo que o profesor reserva para atender e resolver dúbidas ao alumnado en relación a aspectos da materia. Pode desenvolverse de forma individual ou en pequenos grupos, sempre coa finalidade de atender as necesidades e consultas do alumnado relacionadas co estudo e/ou temas vinculados coa materia, proporcionándolle orientación, apoio e motivación no proceso de aprendizaxe. Esta actividade desenvolverase fundamentalmente de maneira directa na aula e nos momentos que o profesor ten asignados ás tutorías de despacho, aínda que de forma puntual pode levar a cabo de forma non presencial (a través do correo electrónico ou do campus virtual). O profesorado informará o horario dispoñible na presentación da materia.
Obradoiro	Tempo que o profesor reserva para atender e resolver dúbidas ao alumnado en relación a aspectos da materia. Pode desenvolverse de forma individual ou en pequenos grupos, sempre coa finalidade de atender as necesidades e consultas do alumnado relacionadas co estudo e/ou temas vinculados coa materia, proporcionándolle orientación, apoio e motivación no proceso de aprendizaxe. Esta actividade desenvolverase fundamentalmente de maneira directa na aula e nos momentos que o profesor ten asignados ás tutorías de despacho, aínda que de forma puntual pode levar a cabo de forma non presencial (a través do correo electrónico ou do campus virtual). O profesorado informará o horario dispoñible na presentación da materia.
Estudo de casos	Tempo que o profesor reserva para atender e resolver dúbidas ao alumnado en relación a aspectos da materia. Pode desenvolverse de forma individual ou en pequenos grupos, sempre coa finalidade de atender as necesidades e consultas do alumnado relacionadas co estudo e/ou temas vinculados coa materia, proporcionándolle orientación, apoio e motivación no proceso de aprendizaxe. Esta actividade desenvolverase fundamentalmente de maneira directa na aula e nos momentos que o profesor ten asignados ás tutorías de despacho, aínda que de forma puntual pode levar a cabo de forma non presencial (a través do correo electrónico ou do campus virtual). O profesorado informará o horario dispoñible na presentación da materia.

Avaliación

	Description	Qualification	Evaluated Competencess

Obradoiro	Asistencia e participación activa nas clases de prácticas. Avaliarase o traballo que o alumno realice de maneira autónoma dentro da aula-seminario-laboratorio (en función da disponiblidade).	5	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13
Estudo de casos	Asistencia e participación activa nas clases de prácticas. Avaliarase o traballo que o alumno realice de maneira autónoma dentro da aula-seminario-laboratorio (en función da disponiblidade).	5	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13
Resolución de problemas e/ou exercicios	Resolución de problemas ou casos prácticos realizados de maneira individual ou en pequenos grupos	20	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13
Exame de preguntas obxectivas	Proba de avaliación. A proba constará de preguntas de resposta curta, problemas e/ou preguntas tipo test.	70	CG1 CE11 CE18 CE19 CT1 CT3 CT4 CT5 CT6 CT8 CT13

Other comments on the Evaluation

Os datos correspondentes a horarios, aulas e datas de exames poderán consultarse de forma actualizada na páxina web do centro: http://aero.uvigo.es/gl/docencia/exames

Para aprobar a materia nesta convocatoria será necesario acadar como mínimo o 40% da nota máxima en cada unha das probas avaliadas. De non alcanzarse dito 40% nalgunha proba, a nota final estará limitada por 4.9
Queda prohibido o uso de calquera tipo de dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir calquera dispositivo non autorizado na aula durante a proba de avaliación será considerado

motivo de non superación da materia. Nese caso o alumno obterá a cualificación de 0 (suspenso).
Avaluiación para non asistentes: a nota será a nota dun examen final para avaliar todas as competencias asignadas á materia.
A duración máxima do exame final será de 2,5 horas, independientemente da convocatoria.

Bibliografía. Fontes de información

Basic Bibliography

William D. Callister, Introducción a la Ciencia e Ingeniería de Materiales, 2ª, Limusa Willey, 2012, México

Donald R. Askeland, Ciencia e ingeniería de los materiales, 6ª, Cengage Learning, 2012, México

William F. Smith, Fundamentos de la Ciencia e Ingeniería de los Materiales, 4ª, McGraw-Hill, 2014, México

Complementary Bibliography

A. Brent, Plastics. Materials and processing, 3ª, Pearson Prentice Hall, 2006, EEUU

J. Antonio Pero-Sanz, Ciencia e ingeniería de materiales. Estructura, transformaciones, propiedades y selección, 5ª, CIE-Dossat 200, 2000, Madrid

Michael F. Ashby, Materiales para ingeniería 1. Introducción a las propiedades, las aplicaciones y el diseño, 1ª, Reverté, 2008, Barcelona

Michael F. Ashby, Materiales para ingeniería 2. Introducción a la microestructura, el procesamiento y el diseño, 1ª, Reverté, 2009, Barcelona

Recomendacións

Subjects that are recommended to be taken simultaneously

Resistencia de materiais e elasticidade/O07G410V01405
Termodinámica/O07G410V01303

Subjects that it is recommended to have taken before

Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201
Química: Química/O07G410V01203

IDENTIFYING DATA				
Classical mechanics				
Subject	Classical mechanics			
Code	O07G410V01305			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	González Salgado, Diego			
Lecturers	González Salgado, Diego Troncoso Casares, Jacobo Antonio			
E-mail	dgs@uvigo.es			
Web	http://aero.uvigo.es			
General description	The students will be instructed in the concepts, laws and main applications of the classical mechanics			

Competencies		
Code		Typology
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• 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
CE15	Appropriate knowledge applied to engineering: Principles of the mechanics of continuous media and techniques for the calculation of their responses.	• know
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know
CT1	Capability of analysis, organization and planification.	• know
CT3	Capability of oral and written communication in native lenguage	• know
CT4	Capability of autonomous learning and information management	• know
CT5	Capability to solve problems and draw decisions	• know
CT6	Capabiliity for interpersonal communication	• know
CT8	Capabiliity for critical and self-critical reasoning	• know

Learning outcomes	
Learning outcomes	Competences
Knowledge, comprehension and application of the statics and dynamics of systems of particles and rigid bodies within the scope of the Classical Mechanics	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Knowledge, comprehension and application of the methods of kinematic and dynamic analysis used in this context.	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Knowledge, comprehension and application of concrete aspects of the Classical Mechanics, for example, the theory of percussions.	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Contents	
Topic	
Kinematics	Inertial and noninertial frames Rotations of a frame: director cosines, Euler angles, Euler parameters, Cayley-Klein parameters. Velocity and acceleration fields. Composition of velocities and accelerations
General equations of mechanics	Equations of Newton dynamics for a particle and a system of particles. Lagrange formulation: calculus of variations, generalized coordinates, principle of D'Alembert, principle of Hamilon, Euler-Lagrange equations, cyclic coordinates, conservation laws.
Dynamics of a particle	Forced and damped oscillations Central forces and gravitation Dynamics with constraints
Dynamics of the rigid body	Center of mass and tensor of inertia. Angular moment and kinetic energy of a rigid body. Equations of the dynamics of a rigid body. Rigid body with a fixed axis. Rigid body with a fixed point. Free rigid body
Statics	Statics of a rigid body in Newton formulation. Statics of a rigid body in Lagrange formulation.
Percussions	General equations for percussions in a rigid body. Study of different types of percussions
Laboratory	Gyroscope equations of motion. Damped and forced oscillations. Mechanical waves. Kater pendulus and coupled pendulus Measurement of the dynamics of a system with a high speed camera. Numerical solution of dynamics problems with Matlab.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	29	36	65
Project based learning	0	2	2
Seminars	8	31.5	39.5
Problem solving	0	20	20
Laboratory practical	12	8	20
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	The first day, the professor will explain the fundamental aspects of the subject and its role in the course
Lecturing	The most relevant parts of the course shall be taught in one-hour sessions. Active participation of students will be welcome
Project based learning	Some aspects of the subject shall be studied by the student using specific teaching methodologies.
Seminars	Professor and students will solve exercises and problems during seminars.
Problem solving	Students will solve problems and exercises independetly
Laboratory practical	Once assessment of parts devoted to theory and exercises is finished, students will enter the laboratory under teacher's supervision. Student's autonomy will be encouraged.

Personalized assistance	
Methodologies	Description
Lecturing	The professor will attend properly the doubts of the students
Laboratory practical	Performance of each student is supervised.
Introductory activities	The professor will attend properly the doubts of the students
Project based learning	The professor will attend properly the doubts of the students
Seminars	The professor will attend properly the doubts of the students

Assessment			
	Description	Qualification	Evaluated Competencess
Lecturing	An exam will be held during classes, jointly with that relative to seminars.	20	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Laboratory practical	Performance in the laboratory will be assessed	10	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Seminars	An exam will be held during classes, jointly with that relative to master sessions.	20	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	Realization of an exam over the whole course contents in the official date.	50	CG1 CG2 CE15 CE19 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

To go further in December/January, a qualification greater than 5 (over 10) will be required. This corresponds to the joint assessment of the official exam and the exam during classes. Secondly, a qualification greater than 5 (over 10) will also be required for the laboratory part. These thresholds being overcame, the final qualification will be obtained according to the balance indicated above. If these thresholds were not overcome but the final qualification was higher than 5, then the student fail the subject with a qualification of 4.9.

To go further in June/July, a qualification greater than 4.5 (over 9) in an exam over theory and problems and a qualification greater than 0.5 (over 1) in an exam over laboratory will be required. If these thresholds were not overcome but the final qualification (the sum of both qualifications) was higher than 5, then the student fails the subject with a qualification of 4.9.The exams will be held on the official date.

The evaluation for students that don't take part in regular classes will be equivalent to the evaluation described for June/July.

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

Sources of information

Basic Bibliography

Ferdinand P. Beer y E. Russell Johnston Jr., Mecánica Vectorial para Ingenieros. Estática (vol. 1) y Dinámica (vol. 2), 5, McGraw Hill, 1990, Naucalpan de Juárez

Antonio Rañada, Dinámica Clásica, 1, Alianza Universidad Textos, 1994, Madrid

Manuel Prieto Alberca, Curso de Mecánica Racional(vol.1 y vol. 2), Aula Documental de Investigación, 1986, Madrid

Jerry B. Marion, Dinámica clásica de las partículas y sistemas, 2, Reverté, 1998, Barcelona

M. Alonso y E. J. Finn, Física, 1, Addison Wesley Iberoamérica, 1995, Wilmington

A. P. French, Vibraciones y ondas, 1, Reverté., 1995, Barcelona

Cornelius Lanzcos, The variational principles of mechanics, 5, University of Bangalore Press, 1997, Bangalore

F. R. Gantmájer, Mecánica Analítica, 1, URSS, 2003, Moscú

Herbert Goldstein, Mecánica Clásica, 1, Reverté, 1990, Barcelona

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Fluid mechanics/O07G410V01402
Resistance of materials and resilience/O07G410V01405

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201

IDENTIFYING DATA				
Matemáticas: Estatística				
Subject	Matemáticas: Estatística			
Code	O07G410V01401			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	2	2c
Teaching language	Castelán Galego			
Department	Estatística e investigación operativa			
Coordinator	Cotos Yáñez, Tomas Raimundo			
Lecturers	Cotos Yáñez, Tomas Raimundo			
E-mail	cotos@uvigo.es			
Web	http://aero.uvigo.es			
General description	Materia pensada para introducir ao alumnado no pensamento estocástico e a modelización de problemas reais. En moitos eidos da ciencia, e a enxeñaría aeroespacial non é unha excepción, débense tomar decisións en moitos casos en contextos de incertidume. Estas decisións involucran procesos previos como obtención da máxima información posible, determinación dos focos de erro e modelización das situacións. Aquí é onde esta materia se ubica. Preténdese introducir as bases para unha análise pormenorizada da información dispoñible. Finalmente, esta materia contribúe a desenvolver o pensamento analítico e matemático que resultará extremadamente útil no exercicio da profesión futura. O idioma Inglés úsase en materiais escritos.			

Competencias		
Code		Typology
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
CE1	Capacidade para a resolución dos problemas matemáticos que poidan exporse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.	• saber • saber facer
CT1	Capacidade de análise, organización e planificación	• saber
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber facer
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber
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

Resultados de aprendizaxe	
Learning outcomes	Competences
Coñecemento e comprensión dos principais conceptos e técnicas do Cálculo de Probabilidades	CE1 CT1 CT4 CT5 CT8
Comprensión das variables aleatorias e a súa clasificación en discretas ou continuas, así como os seus modelos probabilísticos. Habilidade para o cálculo de probabilidades de variables aleatorias a través dos seus modelos probabilísticos. Comprensión e habilidade para obter características de v.a., en particular o valor esperado e a varianza.	CG2 CE1 CT1 CT4 CT5 CT6 CT8
Comprensión dos conceptos elementáis da regresión lineal simple e a correlación. Habilidade para obter o coeficiente de correlación, a ecuación de regresión e os seus parámetros.	CG2 CE1 CT1 CT5 CT8

Habilidade para utilizar os intervalos para facer inferencia sobre os parámetros da poboación. Deducción e interpretación de probas de hipóteses estatística dos intervalos de confianza. Habilidade para utilizar as probas de hipóteses para especificar o modelo probabilístico dunha mostra aleatoria.	CG2 CE1 CT1 CT4 CT6 CT8
Capacidade para aplicalos a outras ramas Científicas das e das Ciencias da Enxeñaría.	CG2 CE1 CT1 CT3 CT5 CT8

Contidos

Topic	
Teoría de Probabilidade. Axiomática.	Espacio mostral, sucesos e probabilidade, combinatoria. Probabilidade condicionada, independencia de sucesos Regra do producto, Probabilidades totais e Teorema de Bayes
Variables aleatorias	Variables aleatorias unidimensionais e bidimensionais: medidas características. Principais v. aleatorias discretas Principais v. aleatorias continuas
Mostraxe e Inferencia estatística	Introducción á inferencia estatística Estimación puntual e por intervalos Contraste de hipóteses paramétricas Contrastes non paramétricos: de bondade de axuste, contrastes de posición, contrastes de independencia, contrastes de homoxeneidade
Regresión	Introdución os modelos de regresión. Regresión lineal simple: estimación, axuste e predición Regresión lineal múltiple

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	18	38	56
Resolución de problemas	23.5	54.5	78
Aprendizaxe baseado en proxectos	0	5	5
Seminario	1	0	1
Práctica de laboratorio	9	0	9

*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 introdutorias	Actividades encamiñadas a tomar contacto e reunir información sobre o alumnado, así como a presentar a materia.
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas, exercicios ou prácticas a desenvolver polo estudante.
Resolución de problemas	Resolución de problemas, lecturas, resumenes, esquemas e cuestións de cada un dos temas do programa da materia. Resolución dos exercicios na pizarra. Farase uso do software estatístico libre R
Aprendizaxe baseado en proxectos	Realización por parte dos estudantes, de forma individual ou en grupo, de diferentes exercicios mediante a planificación e deseño encamiñados á resolución dun problemas real.
Seminario	A través delas o profesor facilitará e orientará os estudantes no seu proceso formativo.

Atención personalizada

Tests	Description
Práctica de laboratorio	Levarase a cabo unha análise individualizada do alumnado mediante o seu traballo nas probas prácticas.

Avaliación

Description	Qualification	Evaluated Competencess

Resolución de problemas	Realizaranse probas escritas e/ou traballos para avaliar a resolución de exercicios e/ou problemas de forma autónoma así como a participación activa.	10	CG2 CE1 CT1 CT3 CT4 CT5 CT6 CT8
Práctica de laboratorio	Realizaranse probas parciais ao longo do cuadrimestre, coas que se pretende comprobar se o alumno vai alcanzando as competencias básicas desta materia. Un alumno que se presente a unha proba parcial entenderase que se escolle a Avaliación por asistencia. A nota de cada proba parcial libera materia.	90	CG2 CE1 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

CRITERIOS DE AVALIACIÓN PARA ASISTENTES NA 1ª EDICIÓN DE ACTAS:

Para que un alumno asistente aprobe a materia na primeira edición de actas, debe obter unha nota mínima de 5 puntos ao sumar as diferentes notas ponderadas, sempre e cando a nota de cada proba non sexa inferior a 3.5 sobre 10. En caso de non acadar nalgunha proba a nota mínima de 3.5, a nota será o mínimo das notas acadadas.
Entenderase por alumno asistente a aquel estudante que se presenta a calquera das probas e deberá de seguir o procedimiento de avaliación descrito anteriormente. A duración máxima de cada proba será de 3 horas.

CRITERIOS DE AVALIACIÓN PARA NON ASISTENTES:

Haberá un sistema de avaliación para os non asistentes consistente nunha única proba onde se avaliará os contidos expostos ao longo do curso. Consistirá na resolución de problemas teórico/prácticos contando coa axuda do software estatístico R (100% da nota). A duración máxima da proba será de 3 horas.

As competencias avaliadas e o resultados de aprendizaxe son todos os que se describen.

CRITERIOS DE AVALIACIÓN PARA ASISTENTES NA 2ª EDICIÓN DE ACTAS E FIN DE CARREIRA:

O sistema de avaliación da convocatoria de Xullo e Fin de Carreira para todos os alumnos será o mesmo que o empregado na 1ª convocatoria para os alumnos non asistentes.

O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da AERO atópase publicado na páxina web do centro http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

Cao Abad, R., Vilar Fernández, J., Presedo Quindimil, M., Vilar Fernández, J., Francisco Fernández, Introducción a la estadística y sus aplicaciones, Pirámide,, 2001,

Ángel Mirás Calvo y Estela Sánchez Rodríguez, Técnicas estadísticas con hoja de cálculo y R : azar y variabilidad en las ciencias naturales, Servizo de Publicacións da Universidade de Vigo, 2018

Montgomery, D. y Runger, G., Probabilidad y Estadística Aplicadas a la Ingeniería, Mc Graw Hill, 1998,

M. H. Rheinfurth and L. W Howell, Probability and Statistics in Aerospace Engineering, University Press of the Pacific, 2006,

Complementary Bibliography

Peña, D., Fundamentos de Estadística, Ciencias Sociales Alianza Editorial, 2001,

R Development Core Team, R: A language and environment for statistical computing, http://www.R-project.org, 2017,

Ugarte, M.D., Militino, A.F., Arnholt, A.T,, Probability and Statistics with R,, CRC Press, 2008,

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Álxebra lineal/O07G410V01102
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201

Other comments

Espérase que o estudantado presente un comportamento ético axeitado. En caso de detectar un comportamento ético non axeitado (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o/a alumno/a non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0.0). No caso de ser necesario, poderase realizar un novo exame para verificar a adquisición de competencias e coñecementos por parte do alumnado implicado.

IDENTIFYING DATA

Mecánica de fluídos

Subject	Mecánica de fluídos			
Code	O07G410V01402			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Rodríguez Pérez, Luis			
Lecturers	Rodríguez Pérez, Luis			
E-mail	lurodriguez@uvigo.es			
Web	http://aero.uvigo.es			
General description	introducense os conceptos e leis que gobernan os movementos de fluídos tratando aspectos laminares e turbulentos.			

Competencias

Code		Typology
CE16	Coñecemento adecuado e aplicado á Enxeñaría de: Os conceptos e as leis que gobernan os procesos de transferencia de enerxía, o movemento dos fluídos, os mecanismos de transmisión de calor e o cambio de materia e o seu papel na análise dos principais sistemas de propulsión aeroespaciais.	• saber • saber facer
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 • saber facer
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 • saber facer
CE28	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en calquera réxime e determinan as distribucións de presións e as forzas aerodinámicas.	• saber • saber facer
CT1	Capacidade de análise, organización e planificación	• Saber estar / ser
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• Saber estar / ser
CT5	Capacidade de resolución de problemas e toma de decisións	• Saber estar / ser
CT6	Capacidade de comunicación interpersoal	• Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• Saber estar / ser

Resultados de aprendizaxe

Learning outcomes	Competences
RA1: Coñecemento, comprensión e aplicación do sentido físico no movemento dos fluídos, das condicións iniciais e de contorno e da lexitimidade dos modelos simplificados.	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT5 CT6 CT8
RA2: Coñecemento, comprensión e aplicación dos conceptos e leis que gobernan os movementos dos fluídos.	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT5 CT6 CT8

Contidos

Topic	
Introdución	Tema 1. Introdución: Conceptos fundamentais da Mecánica de Fluídos. Sólidos, líquidos e gases. Os fluídos como medios continuos. Equilibrio termodinámico local. Partícula fluída. Velocidade, densidade e enerxía interna específica. Viscosidade. Magnitudes fluídas intensivas e extensivas. Ecuacións de estado.
Balances de masa, cantidade de movemento e enerxía	Tema 2. Cinemática de Fluídos: Descricións Lagrangiana e euleriana. Liñas, superficies e volumes fluídos. Traxectorias e sendas. Liñas de traza. Liñas superficies e tubos de corrente. Puntos de remanso. Derivada substancial. Aceleración. Movementos estacionarios e uniformes. Velocidade normal de avance dunha superficie. Fluxo convectivo. Derivación de integrais estendidas a volumes fluídos. Teorema do transporte de Reynolds. Sistemas abertos e sistemas pechados. Movemento relativo na contorna dun punto. Circulación. Movementos irrotacionais. Teorema de Bjerknes-Kelvin. Tensor de velocidades de deformación. Tema 3. Ecuacións Xerais: Principio de conservación da masa. Ecuación da continuidade en forma integral. Ecuación da continuidade en forma diferencial. Función de corrente e función material. Ecuación de cantidade de movemento. Forzas de longo alcance. Forzas de superficie ou de curto alcance. Tensor de esforzos. Ecuación da cantidade de movemento en forma integral. Ecuación da cantidade de movemento en forma diferencial. Lei de Navier-Poisson. Tensor de esforzos viscosos. Ecuación da enerxía en forma integral. Fluxo de calor por condución. Forma diferencial da ecuación da enerxía. Lei de Fourier. Fluxo de calor por condución. Resumo das ecuacións de Mecánica de Fluídos. Condicións iniciais. Condicións de contorno máis usuais. Condición de non escorredura.
Fluidostática	Tema 4. Fluidostática: Ecuacións xerais. Condicións de equilibrio. Función potencial de forzas másicas. Enerxía potencial e principio de conservación da enerxía. Sondas de presión estática. Hidrostática. Equilibrio de gases. Atmosfera estándar
Análise Dimensional e Semellanza Física	Tema 5. Análise Dimensional e Semellanza Física: Teorema Pi de Vaschy-Buckingham. Solucións de semellanza. Semellanza física. Números adimensionais en Mecánica de Fluídos
Movementos laminares e turbulentos en tubos.	Tema 6. Movemento laminar unidireccional de fluídos incompresibles: Corrente de Couette. Corrente de Poiseuille. Movemento laminar en tubos. Perdas de carga en réxime laminar. Factor de fricción. Efecto da entrada. Tema 7. Movemento a baixos números de Reynolds. Ecuacións. Condicións iniciais e de contorno. Aplicación a fluídos incompresibles. Movementos ao redor dun cilindro e unha esfera. Lubricación: Ecuación de Reynolds da lubricación 3D. Aplicacións. Cojinete cilíndrico, lubricación con gases, patín rectángular, outras. Tema 8. Movemento turbulento en tubos: Introdución ao movemento turbulento de fluídos incompresibles en tubos. Inestabilidade do fluxo laminar en tubos. Perdas de carga en réxime turbulento. Factor de fricción. Diagrama de Moody

Introdución a fluídos ideais.	Tema 9. Fluídos ideais. Ecuacións de Euler: Introdución. Fluxos a altos números de Reynolds. Ecuación de Bernoulli. Sondas Pitot. Condicións de remanso. Movemento case estacionario.
Prácticas de laboratorio	Resolución de problemas dos temas expostos en Aula. Ensaio en banco aerodinámico: Visualización de fluxos a baixos números de Reynolds. Visualización de rúas de Karman tras distintos obxectos romos. Observación de cambios de frecuencia do ronsel. Separación de capa límite. Transición de fluxo laminar a fluxo turbulento. Comprobación da ecuación de Bernoulli. Ensaio en túnel de vento: Medición con sonda de Prandtl, toma estática, forzas sobre corpos romos ou aerodinámicos

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	0	30
Resolución de problemas	15.5	0	15.5
Prácticas de laboratorio	4.5	0	4.5
Resolución de problemas de forma autónoma	0	92.5	92.5
Exame de preguntas de desenvolvemento	2.5	1.25	3.75
Exame de preguntas de desenvolvemento	2.5	1.25	3.75

*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 da teoría Translación de problemas de fluídos a modelos matemáticos
Resolución de problemas	Formulación e/ou resolución de modelos aplicados fluxos de fluídos
Prácticas de laboratorio	Realización das prácticas de laboratorio
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios de forma autónoma por parte do alumno para comprender e ser capaz de expor e resolver correctamente os distintos modelos de fluídos estudados no curso

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	Nas prácticas tentarase na medida do posible organizar ao grupo de estudantes en distintas prácticas. Atenderase persoalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas

Avaliación

	Description	Qualification	Evaluated Competencess
Lección maxistral	Asistencia e participación activa nas clases teóricas.	2.5	CE16 CE18 CE19 CE28 CT1 CT3 CT6 CT8

Resolución de problemas	Entrega problemas propostos polo profesor nas clases teóricas e prácticas	5	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT5 CT6
Prácticas de laboratorio	Asistencia e participación activa nas clases prácticas e nas titorías.	2.5	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT6 CT8
Exame de preguntas de desenvolvemento	Realizarase un exame escrito cara á metade do curso sobre o contido abordado nas sesións maxistrais e nas sesións de resolución de problemas ata a data, cun peso do 40% da nota na materia.	40	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT5 CT6 CT8
Exame de preguntas de desenvolvemento	Realizarase un exame ao final do curso sobre o contido abordado nas sesións maxistrais cun peso do 10% e nas sesións de resolución de problemas, cun peso do 40% sobre a nota final na materia.	50	CE16 CE18 CE19 CE28 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

Primeira edición da acta:

A avaliación da materia realizarase en dous exames:

- 1 exame escrito de avaliación continua durante o curso 40% da nota final da materia) de 2.5 h de duración, fora do horario lectivo das clases
- 1 exame escrito final sobre a parte da materia non avaliada no exame de avaliación continua (duración 2.5h, 50% da nota final da materia)

Así mesmo, para a avaliación continua terase en conta a asistencia e participación activa nas clases teóricas e prácticas e nas tutorías (5% da nota final na materia) así como a entrega de problemas propostos polo/a profesor/a nas clases prácticas e/ou teóricas (5% da nota final na materia).

O/as estudantes (suspenso/as ou non) no exame de avaliación continua poderán presentarse, se así o desexan, o día do

exame final a avaliar, de novo, esa parte. A duración da avaliación desa parte será de 2.5h e de novo representará o 40% da nota final da materia.

Os estudantes que non se presentaron ao exame de avaliación continua realizado durante o curso, non poderán presentarse o día do exame final a avaliar de novo esa parte.

Os estudantes que non cursen a materia pola modalidade de avaliación continua, realizarán un exame final de 5h de duración (con descanso no medio) que suporá o 100% da súa nota.

Segunda edición da acta:

O/a estudante que obtivese na avaliación continua (exame escrito de avaliación continua, entrega de problemas propostos e asistencia activa a clases e tutorías) unha nota igual ou superior a un 3.5 sobre 10 gardaráselle a nota para a segunda edición da acta, e examinarase, na segunda edición da acta, dos contidos non avaliados na avaliación continua (exame de 2.5h cun peso dun 40% na nota final)

O/as estudantes que obtivesen na avaliación continua (exame escrito de avaliación continua, entrega de problemas propostos e asistencia activa a clases e tutorías) unha nota inferior a un 3.5 sobre 10, non se lle gardará a nota para a segunda edición da acta, e examinaranse na segunda edición da acta do 100% dos contidos da materia (exame de 5h que suporá o 100% da nota na materia).

O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

A. Liñán Martínez, M. Rodríguez Fernández, F.J. Higuera Antón, Mecánica de fluidos. Vol 1 y 2, Publicaciones de la Escuela Técnica Superior de In, 2003,

Antonio Barrero y Miguel Pérez-Saborid, Fundamentos y Aplicaciones de la Mecánica de Fluidos, Mc Graw Hill, 2005,

Antonio Crespo, Mecánica de fluidos, Ed. Paraninfo, 2006,

Homsy et al., Multi-media Fluid Mechanics,, Cambridge Universty Press, 2000,

Complementary Bibliography

Kundu , Cohen, Fluid Mechanics, 4th Edition, Academic Press, 2010,

White, F.M, Viscous fluid flow, 3rd ed., McGraw-Hill, 2006,

Panton, R. L., Incompressible Flow, 4th Edition, Wiley, 2013,

Recomendacións

Subjects that continue the syllabus

Mecánica de fluídos II e CFD/O07G410V01922

Subjects that are recommended to be taken simultaneously

Termodinámica/O07G410V01303

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103
Física: Física II/O07G410V01202
Matemáticas: Álxebra lineal/O07G410V01102
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201
Matemáticas: Métodos matemáticos/O07G410V01301
Mecánica clásica/O07G410V01305
Termodinámica/O07G410V01303

Other comments

Seguir, por parte do estudante, un estudo continuado da materia.

Seguir ás clases teóricas e prácticas, con atención e resolvendo as dúbidas que poidan xurdir.

Resolver de forma autónoma múltiples problemas de fluídos (por exemplo extraídos da bibliografia proporcionada) por parte do estudante.

Acudir ás titorías para consultar as dúbidas xurdidas ao tentar expor un modelo ou resolver un problema.

IDENTIFYING DATA				
Electrónica e automática				
Subject	Electrónica e automática			
Code	O07G410V01403			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría de sistemas e automática Tecnoloxía electrónica			
Coordinator	García Rivera, Matías			
Lecturers	Castro Miguéns, Carlos García Rivera, Matías			
E-mail	mgrivera@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	Nsta asignatura vense conceptos básicos sobre Electrónica e Regulación Automática			

Competencias		
Code		Typology
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 • saber facer
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
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
CT1	Capacidade de análise, organización e planificación	• saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• 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	• saber facer
CT8	Capacidade de razoamento crítico e autocrítico	• saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences
RA1: Coñecemento e comprensión do funcionamento dos dispositivos electrónicos	CG1 CE17 CT1 CT4 CT5 CT8
RA2: Coñecemento da estrutura básica dos sistemas electrónicos baseados en circuítos dixitais e microprocesadores e a súa aplicación en enxeñaría aeroespacial.	CG1 CG4 CE17 CT1 CT4 CT5 CT8

RA3: Coñecemento xeral dos distintos tipos de sensores e sistemas electrónicos de acondicionamento e adquisición de datos no ámbito das aplicacións aeroespaciais.	CG1 CE17 CT4 CT5 CT8
RA4: Coñecemento da estrutura dos convertidores electrónicos de potencias e das fontes de alimentación.	CE17 CT1 CT4 CT5 CT8
RA5: Coñecemento xeral sobre o modelado dinámico de sistemas.	CG1 CE18 CT1 CT3 CT4 CT5 CT6 CT8
RA6: Coñecemento, análise e aplicación das accións básicas de control.	CG1 CE18 CT1 CT3 CT4 CT5 CT6 CT8
RA7: Coñecemento e comprensión sobre o deseño de reguladores no dominio da frecuencia.	CG1 CG4 CE18 CT1 CT3 CT4 CT5 CT6 CT8

Contidos	
Topic	
Tema 1: Dispositivos electrónicos	1.1 Diodos rectificadores, zener e emisores de luz 1.2 Transistores bipolares, funcionando nas zonas de corte e de saturación. 1.3 Transistores Mosfet, de canle N e de canle P (enhancement type), funcionando nas zonas óhmica e de corte. 1.4 Amplificadores operacionales _ Introdución _ Circuíto adaptador de impedancias (seguidor) _ Circuíto amplificador de ganancia constante _ Circuíto sumador/restador _ Amplificador diferencial _ Xerador de sinais
Tema 2: Electrónica dixital e estrutura de microcontroladores	2.1 Sinais binarias, continuas no tempo 2.2 Sistemas de numeración binario e hexadecimal. 2.3 Álxebra de Boole bivalente ou de conmutación. 2.4 Variables e funcións lóxicas. Representación de funcións lóxicas. 2.5 Portas lóxicas básicas. Implementación de funcións lóxicas sinxelas. 2.6 Bloques funcionais combinacionales e secuenciales 2.7 Memorias semiconductoras. 2.8 Estrutura interna dun microcontrolador _ Unidade central de procesamento _ Memorias _ Portos de entrada/saída _ Módulos internos adicionais
Tema 3: Sensores e circuítos de acondicionamento e de adquisición de datos	3.1 Tipos de sensores (de temperatura, de presión, de humidade, de posición, de movemento, de luz, de corrente eléctrica, biométricos, de gases, de condutividade, de distancia, etc.) 3.2 Circuítos acondicionadores de sinal 3.3 Convertidores analóxico/dixitais

Tema 4: Convertidores de potencia e fontes de alimentación.	4.1 Tipos de convertidores. Características básicas 4.2 Deseño dunha fonte de alimentación lineal.
Tema 5: Modelos matemáticos dos sistemas físicos. Linealización.	
Tema 6: Funcións de transferencia. Diagrama de bloques.	
Tema 7: Estabilidade. Erros. Resposta estática e dinámica.	
Tema 8: Representacións de Bode e Nyquist.	
Tema 9: Accións de control. Deseño de Reguladores no dominio da frecuencia.	

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	28	28	56
Prácticas de laboratorio	14	0	14
Resolución de problemas de forma autónoma	0	70	70
Exame de preguntas de desenvolvemento	5	0	5
Informe de prácticas	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
Lección maxistral	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), nas clases de teoría impartiranse os conceptos necesarios para realizar tanto as prácticas como os problemas e/ou exercicios propostos como actividades non presenciais. Para a exposición dos conceptos teóricos utilizarase tanto o proxector de vídeo como o encerado. O alumnado debe realizar un traballo persoal posterior a cada clase repasando os conceptos expostos nas mesmas. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas clases de teoría exporanse ao alumnado os contidos desta parte da materia.
Prácticas de laboratorio	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), algunhas das clases de grupo reducido dedicaranse a facer prácticas no laboratorio de Electrónica. O resto das clases dedicaranse a resolver exercicios. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas prácticas de laboratorio se formularan, analizarán, resolverán e debaterán problemas relacionados coa temática desta parte da materia.
Resolución de problemas de forma autónoma	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), as clases de grupo reducido que non se dediquen a facer prácticas se dedicarán a facer exercicios. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía) en clase se exporán, analizarán e debateranse problemas e/ou exercicios relacionados coa temática desta parte da materia

Atención personalizada

Methodologies	Description
Lección maxistral	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas sobre ditos temas durante as clases de teoría así como durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e na plataforma Tema, a través da seguinte ligazón: http://faitic.uvigo.es/ Nota: calquera cambio no horario de titorías publicarase tanto na plataforma TEMA (http://faitic.uvigo.es/) como na porta do despacho 312. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.
Prácticas de laboratorio	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), o alumnado pode consultar calquera dúbida sobre as prácticas durante as clases de grupo reducido así como durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e na plataforma Tema, a través da seguinte ligazón: http://faitic.uvigo.es/ Nota: calquera cambio no horario de titorías publicarase tanto na plataforma TEMA (http://faitic.uvigo.es/) como na porta do despacho 312. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.

Resolución de problemas de forma autónoma	En relación aos temas 1 a 4 indicados no apartado Contidos desta guía, o alumnado pode consultar calquera dúbida sobre os exercicios a realizar como actividades non presenciais durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e na plataforma Tema, a través da seguinte ligazón: http://faitic.uvigo.es/ Nota: calquera cambio no horario de titorías publicarase tanto na plataforma TEMA (http://faitic.uvigo.es/) como na porta do despacho 312. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.

Avaliación

	Description	Qualification	Evaluated Competencess
Lección maxistral	En relación á primeira parte da materia (temas 1 a 4 indicados no apartado Contidos desta guía), ao finalizar as clases farase un exame no que se exporán diversas cuestións e problemas sobre os contidos desta parte da materia. Dito exame representa un 50% da nota final da materia. A cualificación deste exame así como a súa influencia na nota final detállase no apartado Outros comentarios e avaliación de Xullo. Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4. En relación á segunda parte da materia (temas 5 a 9 indicados no apartado Contidos desta guía), realizarase unha proba de resposta curta sobre as contidos/competencias/resultados de aprendizaxe dos GRUPOS GRANDES/AULA. Esta proba é obrigatoria e representa un 33% da nota final desta materia. A cualificación deste exame así como a súa influencia na nota final detállase no apartado Outros comentarios e avaliación de Xullo. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	83	CG1 CE17 CE18 CT1 CT3 CT6 CT8
Prácticas de laboratorio	En relación á primeira parte da materia (temas 1 a 4 indicados no apartado Contidos desta guía) faranse unha serie de prácticas. Se se resolven correctamente todas as prácticas propostas entón a este apartado asignaráselle unha cualificación de APTO. En caso contrario asignaráselle unha cualificación de NON APTO. A cualificación de APTO neste apartado é un requisito indispensable para poder aprobar a parte da materia relativa aos temas 1 a 4 na primeira edición da acta (Maio, ver detalles no apartado de Outros comentarios e avaliación de Xullo). Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4 En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) realizarase 1 proba sobre as contidos/competencias/resultados de aprendizaxe das clases de GRUPOS REDUCIDOS/LABORATORIO. Esta proba corresponde a un 12% da nota final desta materia. Esta proba é obrigatoria. A cualificación deste exame así como a súa influencia na nota final detállase no apartado Outros comentarios e avaliación de Xullo. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7	12	CG1 CG4 CE17 CE18 CT1 CT3 CT4 CT5 CT6 CT8
Resolución de problemas de forma autónoma	En relación aos temas 1 a 4 indicados no apartado Contidos desta guía, ao longo do período de docencia desta parte da materia se propondrán unha serie de exercicios e/ou problemas como actividades non presenciais. Se se entregan todos os exercicios correctamente resoltos dentro dos prazos que se indiquen nos correspondentes enunciados, a este apartado asignaráselle unha cualificación de APTO. En caso contrario asignaráselle unha cualificación de NON APTO. A cualificación de APTO neste apartado é un requisito indispensable para poder aprobar a parte da materia relativa aos temas 1 a 4 na primeira edición da acta (Maio, ver detalles no apartado de Outros comentarios e avaliación de Xullo). Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4. En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) a realización de problemas e/ou exercicios valorarase cun máximo de 0.25 puntos na nota final. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	2.5	CG1 CE17 CE18 CT1 CT3 CT4 CT5 CT6 CT8

Informe de prácticas	En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) un informe de prácticas permitirá avaliar a asistencia e participación activa nas clases teóricas e prácticas e nas titorías. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	2.5	CG1 CG4 CE17 CE18 CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

Esta materia consta de dous partes.
Na primeira parte (temas 1 a 4) vense conceptos básicos de Electrónica e na segunda parte (temas 5 a 9) vense conceptos sobre Regulación Automática. O peso de cada parte na nota final é dun 50%. Dado que as notas numéricas nas actas teñen que estar comprendidas entre 0 e 10 puntos [ver Real Decreto 1125/2003 do 5 de setembro (BOE do 18 de setembro) e o acordo do Consello de Goberno do 18/03/2004], cada parte da materia achega unha nota entre 0 e 5 puntos á nota final que se poñerá no acta.
A nota final en calquera edición da acta (Maio, Xullo) obterase sumando as notas (entre 0 e 5 puntos) obtidas en cada unha das dúas partes da materia. Para poder aprobar a materia en calquera edición da acta (Maio, Xullo) será necesario obter unha nota mínima de 2,5 puntos (sobre 5 puntos) en cada unha das dúas partes. No caso de obter unha nota inferior a 2,5 puntos (sobre 5 puntos) nalgunha das partes, a nota final que figurará no acta será a suma das notas obtidas en ambas as partes limitándoa a un máximo de 4 puntos. O calendario de exames, aprobado oficialmente pola Xunta do Centro da EEAE, atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames
PARTE I da materia: Criterios de avaliación para asistentes, relativo aos temas 1 a 4, correspondentes á primeira edición da acta: as competencias adquiridas polos alumnos asistentes na primeira edición da acta, relativas aos temas 1 a 4, avalíanse mediante: _ A realización dunha serie de prácticas no laboratorio. A cualificación final das mesmas será de APTO no caso de que se fagan correctamente todas as prácticas e será de NON APTO no caso de que non sexa así. _ A resolución dunha serie de exercicios e/ou problemas propostos como actividades non presenciais. A cualificación final dos mesmos será de APTO no caso de que se fagan correctamente todos os exercicios e/ou problemas e será de NON APTO no caso de que non sexa así. _ A realización dun exame escrito, o cal se valorará sobre 5.0 puntos. A duración do devandito exame será de 2.5 horas.
Proceso de cualificación: a nota final correspondente á Parte I da materia será igual á nota que se obteña no exame sempre que dita nota non sexa inferior a 2,5 puntos e se obteña unha cualificación de APTO tanto na realización das prácticas como pola resolución dos exercicios e/ou problemas propostos como actividades non presenciais. No caso de que non se obteña unha nota mínima de 2,5 puntos no exame ou unha cualificación de APTO tanto na realización das prácticas como pola resolución dos exercicios e/ou problemas propostos como actividades non presenciais, a nota final desta parte da materia será igual á nota que se obteña no exame, limitándoa a un máximo de 1,5 puntos. Nota: Se unha persoa entrega polo menos un exercicio ou fai polo menos unha práctica considérase que segue a materia de forma presencial e, por tanto, aplicaráselle o procedemento de avaliación para asistentes.
Criterios de avaliación para non asistentes, relativo aos temas 1 a 4, correspondente á primeira edición da acta: as competencias adquiridas polas persoas non asistentes na primeira edición da acta avalíanse mediante dúas probas. Proba 1 (exame escrito): exporanse diversas cuestións e problemas relativos aos temas 1 a 4 indicados no apartado Contidos desta materia. O exame realizarase o mesmo día, á mesma hora e no mesmo lugar que o correspondente exame indicado anteriormente para as persoas asistentes. Devandito exame valorarase sobre 5 puntos, sendo necesario obter unha nota mínima de 2,5 puntos para aprobar esta proba. A duración do exame será de 2,5 horas. Proba 2 (exame no laboratorio): farase unha proba no laboratorio de Electrónica (3ª planta do edificio Politécnico) consistente no deseño, montaxe e/ou simulación de diversos circuítos. Dita proba farase o mesmo día que se faga o exame de teoría. A cualificación da devandita proba será de APTO ou de NON APTO. Nota: é responsabilidade das persoas non asistentes aprender a manexar o hardware e o software que se utiliza nas prácticas relativas aos temas 1 a 4 desta materia con antelación ao día de realización desta proba. A duración do devandito exame será de 2,5 horas.
Proceso de cualificación: no caso de que no exame escrito obtéñase unha nota igual ou superior a 2,5 puntos e de que na proba no laboratorio se obteña unha cualificación de APTO, a nota correspondente aos temas 1 a 4 nesta primeira edición da acta será a que se obteña no exame. No caso de que non se cumpra algunha das condicións anteriores, a nota desta parte da materia será a que se obteña no exame limitándoa a un valor máximo de 1,5 puntos.
Criterios de avaliación para asistentes e non asistentes, relativo aos temas 1 a 4, correspondente á segunda edición da acta: no caso de non aprobar a materia na primeira edición da acta, disponse dunha segunda oportunidade na segunda edición da acta de Xullo. O sistema de avaliación na devandita edición da acta, correspondente aos temas 1 a 4, consistirá na realización dun exame escrito no que se exporán diversas cuestións e problemas. O exame puntuarase sobre 5 puntos, sendo necesario obter unha nota mínima de 2,5 puntos para aprobar esta parte da materia. A duración do exame será de 2,5 horas. Nota: A nota de Electrónica correspondente á convocatoria de maio non se gardará para a convocatoria de xullo,

tanto no caso de asistentes como de non asistentes

PARTE II da materia, AUTOMÁTICA:

CRITERIOS DE AVALIACIÓN DA PARTE DE AUTOMÁTICA (VÁLIDOS PARA ASISTENTES E NON ASISTENTES, EN CALQUERA EDICIÓN DE ACTAS):

- Realización dunha proba de resposta curta relativa ás clases de grupo grande/teoría, valorada en 3.3 puntos. A duración desta proba será de 1.5 horas. Esíxese acadar un mínimo de 1.5 puntos.
- Realización dunha proba proba práctica relativa ás clases de grupo reducido/laboratorio, valorada en 1.2 puntos. A duración desta proba será de 1 hora (Esta proba realizaráse para os alumnos asistentes na clase de grupo reducido durante a última semana de clases, e para os no asistentes despois da proba de respuesta corta). Esíxese acadar un mínimo de 0.5 puntos.
- Resolución dunha serie de exercicios e/ou problemas propostos, valorados en 0.25 puntos.
- A asistencia e a participación activa nas clases valórase cun máximo de 0.25 puntos.

Proceso de cualificación: no caso de acadar o mínimo nas dúas probas, a nota final desta parte da materia será a suma dos catro criterios descritos. No caso de non superar o mínimo nalgunha das dúas probas, a cualificación desta parte será a dita suma, limitada a un máximo de 2.45 puntos.
O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

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T. L. Floyd, Fundamentos de sistemas digitales, Prentice Hall, 2013,

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Daniel W. Hart, Electrónica de Potencia, Prentice Hall, 2005,

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Complementary Bibliography

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Robert F. Coughlin, Frederick F. Driscoll, Amplificadores operacionales y circuitos integrados lineales, Prentice Hall, 2000,

Jordi Mayne, Sensores, acondicionadores y procesadores de señal, Silica. Avnet, 2003,

Miguel A. Pérez García y otros, Instrumentación electrónica, Thomson, 2004,

Edited by Robert H. Bishop, Mechatronic systems, sensors and actuators. Fundamentals and modeling, CRC Press, 2007,

Ashish Tewari, Advanced Control of Aircraft, Spacecraft and Rockets, John Wiley & Sons, 2011,

Michael Cook, Flight Dynamics Principles 3rd Edition A Linear Systems Approach to Aircraft Stability and Control, 3, Butterworth-Heinemann, 2012,

P. J. Swatton, Principles of Flight for Pilots, John Wiley & Sons, 2011,

Wayne Durham, Aircraft Flight Dynamics and Control, Wiley, 2013,

L'Afflitto, Andrea, A Mathematical Perspective on Flight Dynamics and Control, Springer, 2017,

Recomendacións

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103
Física: Física II/O07G410V01202
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201
Enxeñaría eléctrica/O07G410V01302

IDENTIFYING DATA				
Air transport and airborne systems				
Subject	Air transport and airborne systems			
Code	O07G410V01404			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject is divided in two main areas. First, civil aerial transport fundamentals are introduced, as well as the regulatory laws, the elements that constitute it, and its interactions. Second, airborne systems are described. 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
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• Know How
CG7	Capability to analyze and assess the social and environmental impact of technical solutions.	• Know How
CE14	Understand the air transport system and the coordination with other transport modes.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How
CE21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.	• know • Know How
CT1	Capability of analysis, organization and planification.	• Know be
CT2	Leadership, initiative and entrepreneurship	• Know be
CT3	Capability of oral and written communication in native lenguage	• Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know be
CT6	Capabiliity for interpersonal communication	• Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know be

Learning outcomes	
Learning outcomes	Competences
New	CE14 CT1 CT5 CT8
Knowledge of the way in the that the aerial way inserts in the system of transport and the distinct forms of cooperation and competition *intermodales	CG1 CE14 CT1 CT4 CT5 CT8 CT13

Knowledge the economic and social profits of the aerial transport	CG7 CE14 CE21 CT1 CT4 CT5 CT6 CT8 CT13
Understanding of the legal characteristics of the aerial transport and knowledge of the system *regulatorio international in this way	CG1 CG7 CE14 CE21 CT1 CT2 CT3 CT4 CT8 CT13
Knowledge of the different elements that integrate the system of transports: aerial companies, manufacturing, airports, *proveedores of services of aerial navigation	CG1 CG7 CE14 CE19 CT1 CT2 CT4 CT6 CT8 CT13
Comprise the most important aspects of the situation of the aerial transport in the actuality, so much in Spain how in the rest of the world	CG1 CG7 CE14 CE19 CE21 CT1 CT2 CT3 CT4 CT6 CT8 CT13
Comprise the different systems and *subsistemas @embarcar in vehicles *aeroespaciales	CG1 CG7 CE14 CE19 CE21 CT1 CT3 CT4 CT8 CT13

Contents	
Topic	
Aerial transport	Structure and elements that constitue current world-wide transport system. Insertion of the aerial mode in the transport system and the different ways of cooperation and intermodal competition. Economic and social benefits of the aerial transport. Legal frame of the aerial transport and international law system. Elements that constitute the system of transportation: aerial companies, manufacturing, airports, aerial navigation suppliers. Situation of the aerial transport nowadays, in Spain and in the rest of the world.

Onboard systems	Flight reference systems. Flight forces and performance. Stability. Control systems. Navigation systems. Inertial navigation. Positioning navigation. GPS. ILS.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	26	65.5	91.5
Problem solving	11.5	16	27.5
Laboratory practical	8	8	16
Case studies	0	8	8
Problem and/or exercise solving	2	0	2
Problem and/or exercise solving	2	0	2
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	Activities oriented to take contact and gather information for the students, as well as to present the subject.
Lecturing	The teacherwill expose the theoretical bases of the subject. The students will have basic reference texts
Problem solving	The professor will solve problems and exercise and the students will have to solve similar exercises
Laboratory practical	IT and laboratory solutions will be used to solve problems and exercises and apply the knowledge achieved.
Case studies	The teacher will solve problems and exercises and the students will have to solve similar exercises

Personalized assistance

Methodologies	Description
Lecturing	The teacher will attend personally the doubts and queries of the students, in person, or by telematic support.
Problem solving	The teacher will attend personally the doubts and queries of the students, in person, or by telematic support.
Laboratory practical	The teacher will attend personally the doubts and queries of the students, in person, or by telematic support.

Assessment

	Description	Qualification	Evaluated Competencess
Problem and/or exercise solving	Exams and projects will be done to evaluate autonomous resolution of exercises and/or problems as well as the assistance and active participation.	20	CG1 CG7 CE14 CE19 CE21 CT1 CT2 CT3 CT4 CT5 CT6 CT8 CT13

Problem and/or exercise solving	Evaluation of the acquisition of knowledge will be performed by exams.	10	CG1 CG7 CE14 CE19 CE21 CT1 CT2 CT3 CT4 CT5 CT6 CT8 CT13
Essay questions exam	Final written exam.	70	CG1 CG7 CE14 CE19 CE21 CT1 CT2 CT3 CT4 CT5 CT6 CT8 CT13

Other comments on the Evaluation

The examination has to reach at least a 4 (on a scale of 0 to 10)
To be able to pass the subject; if it does not reach the 4, the final note be the minimum between the weighted note (according to the indicated percentages) and 4.9.

Non-assistent students will have the possibility to make an examination that covers all the matter.

The assessment of July follows the same way (saves the results of the continuous evaluation).

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

Sources of information

Basic Bibliography

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A. Benito, Descubrir las líneas aéreas, AENA,

J. Anderson, An Introduction to flight, McGraw&Hill,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Aerospace technology/O07G410V01205

IDENTIFYING DATA				
Resistance of materials and resilience				
Subject	Resistance of materials and resilience			
Code	O07G410V01405			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Conde Carnero, Borja			
Lecturers	Bendaña Jácome, Ricardo Javier Conde Carnero, Borja			
E-mail	bconde@uvigo.es			
Web	http://aero.uvigo.es			
General description	Foundations of the theory of elasticity and strength of materials. Applications to the field of 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
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• 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
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CE7	Understand the behavior of structures before their request in conditions of service and critical situations.	• know • Know How
CE15	Appropriate knowledge applied to engineering: Principles of the mechanics of continuous media and techniques for the calculation of their responses.	• know • Know How
CE18	Appropriate knowledge applied to the engineering: foundations of fluid mechanics; basic principles of control and automation of flight; main characteristics and physical and mechanical properties of the materials.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How
CT1	Capability of analysis, organization and planification.	• Know be
CT3	Capability of oral and written communication in native lenguage	• Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know be
CT6	Capabiliity for interpersonal communication	• Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know be

Learning outcomes	
Learning outcomes	Competences

Understanding, analysis and calculation of simple problems of structural elements under linear behaviour	CG1 CE7 CE15 CE18 CE19 CT1 CT4 CT5 CT8
Understanding of the basic theory and solution of some fundamental problems in linear elasticity of solids	CG1 CG4 CE7 CE15 CE18 CE19 CT1 CT3 CT4 CT5 CT8
Knowledge, understanding and application of analysis methods	CG1 CG2 CG4 CE7 CE15 CE18 CE19 CT1 CT3 CT4 CT5 CT8
Application, analysis and synthesis of structures	CG1 CG2 CG4 CE7 CE15 CE18 CT1 CT3 CT4 CT5 CT6 CT8

Contents	
Topic	
1.- Introduction to the study of elasticity and strength of materials	1.1.- Aim of elasticity and strength of materials. 1.2.- Concept of deformable solid. 1.3.- The beam element. 1.4.- Static equilibrium and elastic equilibrium. 1.5.- Stress resultants. 1.6.- Concept of stress.
2.- Internal forces	2.1.- Introduction. 2.2.- Internal forces in a beam. 2.3.- Relations between internal forces and external forces. 2.4.- Sign convention. 2.5.- Relations among load, shear, and bending moment. 2.6.- Internal forces diagrams.
3.- Axial loading	3.1.- Introduction. 3.2.- Stresses. 3.3.- Strains. 3.4.- Statically indeterminate problems.

4.- Bending	4.1.- Pure bending. 4.2.- Symmetric and unsymmetric bending. 4.3.- Bending and axial loading. 4.4.- Deflections due to bending. 4.5.- Differential equation for deflection. 4.6.- Mohr's theorems. 4.7.- The conjugate-beam method. 4.8.- Statically indeterminate beams.
5.- Torsion	5.1.- Circular section.
6.- Energy methods in structural analysis	6.1.- Introduction. 6.2.- Strain energy of a beam. 6.3.- Maxwell-Betti reciprocal work theorem. 6.4.- Castigliano's theorem.
7.- Stress analysis	7.1.- Components of the stress vector. 7.2.- Equilibrium of the elementary parallelepiped. 7.3.- Stress tensor. 7.4.- Principal stresses and directions. 7.5.- Spherical and deviatoric stress tensors. 7.6.- Mohr's circle.
8.- Strain analysis	8.1.- Deformation of the elementary parallelepiped. 8.2.- Concept of strain. 8.3.- Strain tensor. 8.4.- Principal strains and directions. 8.5.- Changes of volume, area and length. 8.6.- Mohr's circle.
9.- Elastic solid	9.1.- Mechanical behaviour of the materials. 9.2.- Material constitutive models. 9.3.- The linear elastic model. 9.4.- Two-dimensional elasticity. 9.5.- The elastic problem. 9.6.- Yielding criteria.
10.- Matrix analysis of structures	10.1.- Introduction to the direct stiffness method. 10.2.- Stiffness matrix of truss and beam elements. 10.3.- Global stiffness matrix assembly. 10.4.- Application of the boundary conditions. 10.5.- Response of the structure: displacements, support reactions and member forces. 10.6.- Particular cases.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Laboratory practical	18	37.5	55.5
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	Exposition in the classroom of the basic theory of the subject.
Laboratory practical	Resolution of problems related with the theoretical contents.

Personalized assistance

Methodologies	Description
Lecturing	
Laboratory practical	

Assessment

Description	Qualification	Evaluated Competencess

Laboratory practical	Attendance to and active participation in the practical sessions. Resolution of problems and/or exercises by the student.	10	CG1 CG2 CG4 CE7 CE15 CE18 CE19 CT1 CT3 CT4 CT5 CT8
Essay questions exam	Examination of the contents of all the subject.	90	CE7 CE15 CE18 CE19 CT1 CT3 CT5 CT8

Other comments on the Evaluation

Students that officially renounce to the continuous assessment

In this case, the mark obtained in the exam will represent 100% of the subject grade.

Practical sessions

Each practical session is on a specific date, thus it is not possible to recover them. Exceptionally, non-attended sessions could be justified by means of an official certificate (doctor, court, etc.).

Evaluation test

The dates of evaluation tests officially approved by the EEAE can be found in the following webpage: http://aero.uvigo.es/gl/docencia/exames. The maximum time of the examen will be 3 hours if a break is not contemplated, or 5 hours when including a break (being 3 hours the maximum time for each part).

The use of any electronic device during the evaluation test will not be allowed unless expressly authorized. The fact of introducing an electronic device not authorized in the exam room will be considered a reason for not passing the subject in the current academic year, and the overall rating will be 0.0.

Ethical commitment

It is expected from the student an appropriate behaviour. In the case of detecting unethical behaviour (copy, plagiarism, use of unauthorized electronic devices and others) it is considered that the student does not meet the necessary requirements to pass the subject. Thus, the overall grade in this academic year will be 0.0.

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames

Sources of information

Basic Bibliography

Ricardo Bendaña, Ejercicios de resistencia de materiales y cálculo de estructuras para ingenieros, Galiza Editora, 2005,

Manuel Vazquez, Resistencia de materiales, Noela, 2000,

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Recommendations
Subjects that continue the syllabus
Solid mechanics and aerospace structures/O07G410V01921

Subjects that it is recommended to have taken before
Graphic expression: Graphic expression/O07G410V01105
Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201

IDENTIFYING DATA				
Fabricación aeroespacial				
Subject	Fabricación aeroespacial			
Code	O07G410V01501			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	Pereira Domínguez, Alejandro Pérez García, José Antonio			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	Esta materia introduce aspectos da tecnoloxía, dos procesos, da planificación e do control da calidade no eido da fabricación aeroespacial.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • Saber estar / ser
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• Saber estar / ser
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• Saber estar / ser
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 • saber facer
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
CE12	Comprender os procesos de fabricación.	• saber • saber facer
CT2	Liderado, iniciativa e espírito emprendedor	• saber facer • Saber estar / ser
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber • saber facer
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• Saber estar / ser
CT6	Capacidade de comunicación interpersoal	• saber facer
CT8	Capacidade de razoamento crítico e autocrítico	• saber • saber facer
CT9	Capacidade de traballo en equipo de carácter interdisciplinar	• Saber estar / ser
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• Saber estar / ser
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• Saber estar / ser

Resultados de aprendizaxe	
Learning outcomes	Competences

- Interpretación, confección e xestión de documentos técnicos, para o deseño conceptual, preliminar e detalle de modelos físicos e sistemas - Coñecemento dos principios xerais sobre deseño xeométrico, funcional e os específicos dos elementos e instalacións propias das espe- cialidades - Criterios de calidade e análise destes deseños. O alumno coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación - O alumno ou a alumna coñece toda a información necesaria para levar a cabo un proceso de produción - O alumno ou a alumna é capaz de realizar un informe que permita a execución exitosa dun proceso de produción	CB2 CB3 CB5 CG1 CG2 CE12 CT2 CT3 CT4 CT6 CT8 CT9 CT11 CT13

Contidos	
Topic	
01 - Integración de Deseño e Fabricación	01.1 Requisitos propios dos compoñentes deseñados no sector aeroespacial 01.2 Deseño para fabricación e ensamblaje (DFMA) 01.3 Sistemas de fabricación aeroespacial. Compoñentes e tipos
02 - Técnicas de Conformado na Fabricación Aeroespacial	02.1 Fabricación Aditiva 02.2. Conformado de Materiais Compostos 02.3. Conformado por Arranque de Labra 02.4. Conformado por Moldeo 02.5. Conformado de Materiais Plásticos 02.6. Conformado por Deformación Plástica
03 - Fabricación Virtual	03.1 Simulación de Procesos de Fabricación
04 - Técnicas de Unión e Ensamblaje na Fabricación Aeroespacial	04.1 Procesos de Unión Mecánica 04.2 Procesos de Unión Química e Adhesivos 04.3 Procesos de Soldadura 04.4 Utillajes de Ensamblaje 04.5 Loxística de Manutención
05 - Técnicas de Inspección no ámbito Aeroespacial	05.1. Técnicas de medición, dimensional, formas xeométricas e calidade superficial 05.2 Útiles e calibres de verificación 05.3 Control Estatístico de Proceso

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	8	16	24
Resolución de problemas	8	16	24
Aprendizaxe baseado en proxectos	12	24	36
Prácticas en aulas informáticas	14	28	42
Prácticas de laboratorio	6	12	18
Saídas de estudo	2.5	1.5	4
Resolución de problemas e/ou exercicios	1	0	1
Traballo	1	0	1
*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	Indicacións básicas de contidos. Farase referencia a bibliografía, publicacións e desenvolvementos. Descrición de casos
Resolución de problemas	En determinados temas exporanse problemas a resolver, realizando os cálculos necesarios
Aprendizaxe baseado en proxectos	O obxectivo prioritario deste curso será a aprendizaxe adquirida mediante o deseño e desenvolvemento de produto/proceso, que se realizará en función dos medios dispoñibles, aplicando contidos, técnicas e resolución de problemas, adquiridos en teoría e práctica
Prácticas en aulas informáticas	Realización de fases de Deseño conceptual, deseño detallado, planificación de proceso e programación mediante plataforma CAD/CAM dispoñible
Prácticas de laboratorio	Realizaranse fases de fabricación de produtos e utillaje prototipo en materiais poliméricos, e metálicos en función dos medios dispoñibles.
Saídas de estudo	Dependendo da dispoñibilidade e numero permitido de persoas por visita realizaríanse viaxes a empresas do sector aeronáutico.

Atención personalizada

Methodologies	Description
Resolución de problemas	resolución dubidas particulares
Prácticas en aulas informáticas	Exposición de metodoloxías de deseño e desenvolvemento de produto/proceso, orientados aos distintos traballos escollidos por grupos de alumnos
Prácticas de laboratorio	Fabricación de prototipos poliméricos e metálicos seleccionados
Aprendizaxe baseado en proxectos	Totalmente personalizado ao proxecto particular de alumno ou grupo de alumnos

Avaliación

	Description	Qualification	Evaluated Competencess
Lección maxistral	Proba escrita	20	CE12 CT3
Resolución de problemas	Proba escrita	20	CE12 CT3 CT8
Prácticas en aulas informáticas	Proba escrita	20	CG2 CE12
Prácticas de laboratorio	Proba escrita	20	CG2 CE12
Aprendizaxe baseado en proxectos	Traballo	20	CG2 CE12 CT3 CT8 CT9

Other comments on the Evaluation

PRIMEIRA EDICIÓN DA ACTA: A materia avalíase en base a dous parámetros: Exame de Teoría / Problemas (nota máxima 8 puntos) Traballo da Materia (nota máxima 2 puntos) Aprobarán a materia aqueles alumnos que consigan, entre os dous apartados, unha nota igual ou superior a 5 puntos

SEGUNDA e SUCESIVAS EDICIONES DAS ACTAS O método de Avaliación é o mesmo que o descrito para a PRIMEIRA EDICIÓN DA ACTA.
OUTRAS CONSIDERACIÓNS: Os traballos serán entregados o día do Exame da materia. En caso de discrepancia entre o contido da Guia Docente nas súas versións en Castelán, Galllego e Inglés, prevalecerá o establecido na versión en Castelán Realizarase unha proba escrita de desenvolvemento a aqueles alumnos que, por causas excepcionais e xustificadas, non realicen traballo de curso.
O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

J.T. Black, Ronald A. Kohser, DeGarmo□s Materials and Processes in Manufacturing, 12, Wiley, 2017, Hoboken, NJ :

Complementary Bibliography

Kalpakjian, Serope, Manufacturing engineering and technology, 7, Pearson Education, 2014, Jurong, Singapore
Mikell P. Groover, Principles of modern manufacturing, 5, John Wiley & Sons, 2013, Singapore

Recomendacións

Subjects that continue the syllabus

Tecnoloxías para conformado de materiais aeroespaciais/O07G410V01913

IDENTIFYING DATA				
Proyect direction and management				
Subject	Proyect direction and management			
Code	O07G410V01701			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	This subject covers the technical, economic, financial, legal and management aspects about aerospace projects. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• 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
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CG5	Capability to carry out projection activities, technical management, expert training, drafting reports, opinions, and technical advice in tasks related to aeronautical technical engineering, exercise of functions with real aerospace character.	• know • Know How
CG7	Capability to analyze and assess the social and environmental impact of technical solutions.	• know • Know How
CG8	Knowledge, understanding and capability to apply necessary legislation in the profession as aeronautical technical engineer.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How
CT2	Leadership, initiative and entrepreneurship	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How

CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT9	Capability to work in interdisciplinary teams	• know • Know How
CT10	Capability to negotiate and deal with and act in situations of conflict	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be
CT12	Ethical and democratic commitment	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know be

Learning outcomes

Learning outcomes	Competences
- Knowledge, understanding, analysis and synthesis of the economic management of a company and project management.	CB2 CB3 CB4 CB5 CG1 CG2 CG4 CG5 CE19 CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT11 CT12
- Knowledge of the determining factors of the environmental impact of the aeronautical sector.	CB2 CB3 CB4 CB5 CG1 CG2 CG4 CG5 CG7 CG8 CE19 CT3 CT4 CT5 CT6 CT8 CT11 CT12 CT13

Contents

Topic
Unit 1. Business management: management role. Management of human resources and knowledge.
Unit 2. Quality Management. Marketing Management
Unit 3. Economic-financial management of the company.
Unit 4. Engineering projects clasification. Planning, evaluation and project control
Unit 5. Management of the scope, time, quality, human resources and communications of a project. Cost and risk
Unit 6. Project key point indicators
Unit 7. Environmental impact of airports, airlines and aeronautical facilities. Legal restrictions

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32	63	95
Mentored work	9	15	24
Laboratory practical	9	18	27
Essay questions exam	2	0	2
Presentation	0.5	1.5	2

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

Methodologies	
	Description
Lecturing	Presentation by the teacher of the contents on the subject under study, theoretical and / or guidelines for a job, exercise or project to be developed by the student.
Mentored work	The student, individually or in groups, prepares a paper on the subject of matter or prepare seminars, research, memoirs, essays, summaries of readings, lectures, etc.. Generally it is an autonomous activity of the student that includes finding and collecting information, reading and literature management, writing ...
Laboratory practical	Activities application of knowledge to specific situations and basic skills acquisition and related procedural matter under study. They are developed in specific spaces with specialized equipment (Laboratories, computer rooms, etc ...)

Personalized assistance	
Methodologies	Description
Lecturing	In the field of tutorial action, academic tutoring actions are distinguished, as well as personalized tutoring. In the first case, the students will have at their disposal hours of tutorials in which they can consult any doubt related to the contents, organization and planning of the subject, with the development of the project, etc. The tutorials can be individualized, but group tutoring will be encouraged to solve problems related to the activities to be carried out in groups, or simply to inform the teacher of the evolution of the collaborative work. In the personalized tutorials, each student, individually, can discuss with the teacher any problem that is preventing him from properly monitoring the subject, in order to find some types of solution between them. By combining both types of tutorial action, it is intended to compensate the different learning rhythms through attention to diversity.
Mentored work	In the field of tutorial action, academic tutoring actions are distinguished, as well as personalized tutoring. In the first case, the students will have at their disposal hours of tutorials in which they can consult any doubt related to the contents, organization and planning of the subject, with the development of the project, etc. The tutorials can be individualized, but group tutoring will be encouraged to solve problems related to the activities to be carried out in groups, or simply to inform the teacher of the evolution of the collaborative work. In the personalized tutorials, each student, individually, can discuss with the teacher any problem that is preventing him from properly monitoring the subject, in order to find some types of solution between them. By combining both types of tutorial action, it is intended to compensate the different learning rhythms through attention to diversity.

Assessment			
	Description	Qualification	Evaluated Competencess

Laboratory practical	Laboratory practice memory	25	CB2 CB3 CB5 CG1 CG2 CG4 CG5 CG7 CG8 CE19 CT3 CT4 CT5 CT8 CT11 CT13
Essay questions exam	Performing partial tests and a final continuous assessment exam	50	CB2 CB3 CB5 CG1 CG2 CG4 CG5 CG7 CG8 CE19 CT3 CT4 CT5 CT11 CT13

Presentation	Presentation in class of the group work developed.	25	CB2 CB3 CB4 CB5 CG1 CG2 CG4 CG5 CG7 CG8 CE19 CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT11 CT12 CT13

Other comments on the Evaluation

The minimum grade to be reached in the final continuous assessment exam will be 4.0 in order to pass the subject.

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames

In the case of not reaching said grade, the final grade will be the result of the minimum of the average score of EC and 4.0. Extraordinary call Students who have not passed the subject in the ordinary call will perform an extraordinary exam that will have the same format and the same requirements as the ordinary exam.

In the extraordinary evaluation, an examination in three parts will be carried out that will suppose the complete score of the evaluation: short answer, long answer (development), and problems.

As a student of the University of Vigo, the Statute for University Students, approved by Royal Decree 1791/2010 of December 30, establishes in its article 12, point 2d, that the university student has the duty to "abstain from the use or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university ". Therefore, it is expected that the student has an adequate ethical behavior. If unethical behavior is detected during the course (copying, plagiarism, use of unauthorized electronic devices or others), the student will be penalized with a grade of "0.0" in the written or deliverable test where said fraud was detected.

Sources of information

Basic Bibliography

Project Management Institute, Guía de los Fundamentos Para la Dirección de Proyectos (guía del PMBOK), 6, Project Management Institute, 2017,

Cindy Lewis, Carl Chatfield, Timothy Johnson, Microsoft Project 2019 Step by Step, Microsoft Press, 2019,

Philip Kotler, Fundamentos De Marketing, 13, ADDISON-WESLEY, 2017,

Montserrat Cabrerizo, Gestión Económica y Financiera de la Empresa, 2, Marcombo Formación, 2017,

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Navigational systems				
Subject	Navigational systems			
Code	O07G410V01901			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	González Jorge, Higinio			
Lecturers	González Jorge, Higinio			
E-mail	higiniog@uvigo.es			
Web	http://aero.uvigo.es			
General description	This course expose the main procedures and systems used in aircraft navigation. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know
CT6	Capabiliity for interpersonal communication	• know
CT8	Capabiliity for critical and self-critical reasoning	• know
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know

Learning outcomes	
Learning outcomes	Competences
Understanding of the need for aircraft navigation systems	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11

Understanding of the theoretical foundations and operation of aircarft navigation systems. Understanding of external agents that affect these systems.	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11
Understanding of the methods to ensure the proper working of these systems.	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11

Contents	
Topic	
1. Introduction to aircarft navigation.	1.1. Basic concepts of cartography and geodesy. 1.2. Aeronautical charts. 1.3. Aircarft navigation concept. Observed, estimated, radioelectric and autonomous navigation. 1.4. Terminology (heading, azimuth, magnetic declination, nautical mile, knot, foot, etc.). 1.5. The wind in the air navigation. Wind triangle. 1.6. Orthodromic route. Characteristics, parameters and equations. 1.7. Loxodromic route. Characteristics, parameters and equations. 1.8. The altimetry in air navigation. Standard atmosphere. Pressure, density and temperature. The barometric altimeter.
2. Meteorology and aircarft navigation.	2.1. VMC and IMC weather conditions. Visual and instrumental navigation. VFR and IFR flight rules. 2.2. Basic flight instruments. 2.3. Technical requirements for visual and instrumental flight. 2.4. Organization of the aeronautical meteorological service in Spain through AEMET.
3. Conventional navigation systems.	3.1. Directional radio signals. 3.2. Route beacons. 3.3. Automatic direction finder (ADF). 3.4. Non-directional beacon (NDB). 3.5. High frequency omnidirectional radio beacon (VOR). 3.6. Long Range Navigation systems (LORAN and NavSat).
4. RNAV navigation.	4.1. Three-dimensional navigation system. Course line computer. 4.2. Inertial navigation system (INS). 4.3. Doppler radar.
5. Distance measuring equipment (DME).	5.1. Frequencies 5.2. DME theory. 5.3. Specifications and errors.
6. Instrument landing system (ILS).	6.1. Guide and locator information. Ground and on board systems. 6.2. Glide path. Ground and on board systems. 6.3. Distance information. Radio beacon. Ground and on board systems. 6.4. Compass radio beacons. 6.5. Visual information. VASIS system. 6.6 Category of the ILS.
7. Microwave landing system (MLS).	7.1. MLS principles. 7.2. Ground system. 7.3. On board system.
8. RADAR.	8.1. Introduction. 8.2. Primary RADAR. 8.3. Secondary RADAR. 8.4. Meteorological RADAR.

9. Global Navigation Satellite System (GNSS).	9.1. Principles of satellite navigation. 9.2. GNSS segments. 9.3. GNSS signals. 9.4. Operation of the GNSS system. 9.5. GPS, GLONASS, GALILEO and BEIDOU systems. 9.6. The future of the GNSS system.
10. Air traffic control systems (ATC).	10.1. Review of ATC systems. 10.2. Transponders 10.3. On board systems. 10.4. System operation 10.5. ADSB system. 10.6. Communications, navigation and surveillance in ATC.
11. Traffic alert and collision avoidance system (TCAS).	11.1. TCAS system. 11.2. TCAS operation.
12. Aircarft navigation and unmanned aerial vehicles.	12.1. Airspace. 12.2. Rules for unmanned aerial vehicles. 12.3. On board navigation systems in unmanned aerial vehicles. 12.4. Future trens in unmanned aerial vehicles.
13. Aircraft navigation and safety.	13.1. Governmental aeronautical safety agency (AESA). 13.2. Aircraft navigation services in Spain (ENAIRE). Air traffic management. Aeronautical information service (AIS).

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	0	26
Computer practices	26	0	26
Mentored work	0	98	98

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

Methodologies

	Description
Lecturing	Exhibition of the contents of the subject through audiovisual media.
Computer practices	Problem solving through software tools such as Python, QGIS, Mission Planner or Plane Finder.
Mentored work	The student will perform a project that consist of designing, implementing and verifying a navigation system for an unmanned aircraft, based on the GNSS and the INS system.

Personalized assistance

Methodologies	Description
Lecturing	Classroom attention. Face-to-face tutorials. Attention by email.
Computer practices	Classroom attention. Face-to-face tutorials. Attention by email.
Mentored work	Face-to-face tutorials. Attention by email.

Assessment

	Description	Qualification	Evaluated Competencess
Lecturing	There will be two partial exams to test the theoretical content of the subject. Each one will have a weight of 20% in the global mark of the subject. Each exam will consist of a total of 20 questions. Each successful question will score 0.5 points out of 10. Each failed question will subtract 0.1 points out of 10.	40	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11

Computer practices	Each practice will define a deliverable that the student must send to the professor before the indicated deadline.	40	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11
Mentored work	The student must deliver a final report with the work done. In addition, the student must demonstrate the correct working of the developed system to the professor.	20	CB2 CB3 CB5 CG1 CG6 CE19 CT3 CT4 CT6 CT8 CT11

Other comments on the Evaluation

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

The official exam dates will be used so that the student can retrieve any of the evaluation parts indicated above. This applies to students attending the classroom as well as to non-attendant students.

Marks are not kept between different academic courses.

Sources of information

Basic Bibliography

Mike Tooley and David Wyatt, Aircraft communications and navigation systems, Elsevier, 2007,

Eduardo Huerta, Aldo Mangiaterra y Gustavo Noguera, GPS. Posicionamiento satelital, UNR Editora, 2005, https://www.fceia.unr.edu.ar/gps/GGSR/libro_gps.pdf

Myron Kayton and Walter R. Fried, Avionics navigation systems, Wiley, 1997,

Complementary Bibliography

Robert Arán Escuer y J. R. Aragoneses Manso, Sistemas de navegación aérea, Paraninfo, 1983,

Recommendations

Subjects that it is recommended to have taken before

Systems engineering and aerospace communications/O07G410V01925

IDENTIFYING DATA				
Dynamic FEM and vibrations				
Subject	Dynamic FEM and vibrations			
Code	O07G410V01902			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Materiais para a industria aeroespacial				
Subject	Materiais para a industria aeroespacial			
Code	O07G410V01903			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Guitián Saco, María Beatriz			
Lecturers	Guitián Saco, María Beatriz			
E-mail	bea.guitian@uvigo.es			
Web	http://dept05.webs.uvigo.es/			
General description	Esta materia é unha introdución á ciencia dos materiais. O obxectivo é ofrecer ao alumnado unha visión xeral dos distintos tipos de materiais, as súas propiedades e aplicacións fundamentais.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • saber facer
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	
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 • saber facer
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.	• saber • saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber facer • Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber facer • Saber estar / ser
CT5	Capacidade de resolución de problemas e toma de decisións	• saber facer
CT6	Capacidade de comunicación interpersoal	• saber facer • Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• saber facer
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• saber • saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences
Coñecemento e comprensión dos Materiais para aplicacións Aeroespaciais: capacidade de identificar as súas diferenzas.	CB2 CB3 CB5 CG1 CE20 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Coñecemento xeral dos distintos materiais non metálicos utilizados na enxeñaría, como son os materiais poliméricos, os materiais cerámicos, os materiais compostos, etc.	CB2 CB3 CB5 CG1 CE20 CT3 CT4 CT5 CT6 CT8 CT11 CT13
Coñecemento e comprensión dos Materiais para aplicacións Aeroespaciais: métodos de fabricación e optimización.	CB2 CB3 CB5 CG1 CE20 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Contidos	
Topic	
Tema 1. Aliaxes de uso aeroespacial.	Aliaxes lixeiras e superaleaciones. Fabricación e optimización de aliaxes. Propiedades mecánicas e térmicas das aliaxes.
Tema 2. Materiais Compostos.	Clasificación. Procesos de fabricación de materiais compostos. propiedades mecánicas e térmicas dos materiais.
Tema 3. Comportamento e fallo en servizo de materiais aeroespaciais (I).	Fricción e desgaste. Fraxilización. Fractura. Corrosión e degradación. Fatiga. Termofluencia.
Tema 4. Comportamento e fallo en servizo de materiais aeroespaciais (II).	Análise de fallos. Tecnicas de detección e inspección de fallos.
Tema 5. Unións mecánicas e adhesivas.	Unión mecánica. Soldadura. Adhesivos. Unións hibridas.
Tema 6. Certificación de estruturas aeronauticas.	Seguridade operacional. Mantemento.

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	24.5	61.25	85.75
Prácticas de laboratorio	10	30	40
Resolución de problemas de forma autónoma	5	7.25	12.25
Saídas de estudo	8	0	8
Exame de preguntas obxectivas	2	0	2
Presentación	0.5	1.5	2
*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 da materia.
Prácticas de laboratorio	Actividades para a aplicación práctica dos coñecementos adquiridos.
Resolución de problemas de forma autónoma	Resolución de problemas e exercicios relacionados coa materia.
Saídas de estudo	Visitas en grupo reducido a empresas do sector aeronáutico.

Atención personalizada	
Methodologies	Description
Prácticas de laboratorio	Tempo no que o profesor axuda ao alumno a resolver e realizar as actividades expostas nas prácticas de laboratorio.
Resolución de problemas de forma autónoma	Orientación que o profesorado presta ao alumnado para o desenvolvemento correcto dos problemas expostos.

Lección maxistral	Atención que o profesorado presta de maneira individual ao alumnado para resolver as dúbidas e dificultades que este atope na compresnsión dos contidos da materia.

Avaliación

	Description	Qualification	Evaluated Competencess
Prácticas de laboratorio	Informes da relización de practícas que o alumno/a deberá entregar de maneira individual ou por grupos.	20	CB2 CB3 CB5 CG1 CE20 CT4 CT5 CT6 CT8 CT11 CT13
Exame de preguntas obxectivas	Proba escrita individual na que o/a alumno/a deberá responder a cuestións relativas á materia presentada na aula.	60	CB2 CB3 CB5 CG1 CE20 CT3 CT4 CT5 CT8 CT11 CT13
Presentación	Presentación oral por grupos dun tema proposto durante o desenvolvemento da materia.	20	CB2 CB3 CB5 CG1 CE20 CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

Os datos correspondentes a horarios, aulas e datas de examenes poderán consultarse de forma actualizada na páxina web do centro: http://aero.uvigo.es/gl/docencia/examenes

Para aprobar a materia nesta convocatoria será necesario acadar como mínimo o 40% da nota máxima en cada unha das probas avaliadas. De non alcanzarse devandito 40% nalgunha proba, a nota final estará limitada por 4.9
Queda prohibido o uso de calquera tipo de dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir calquera dispositivo non autorizado na aula durante a proba de avaliación será considerado motivo de non superación da materia. Nese caso o alumno obterá a calificación de 0 (suspenso).

Avaliación para non asistentes: a nota será a dun exame final para avaliar todas as competencias asignadas á materia.
A duración máxima do examen será de 2,5 horas, independentemente da convocatoria.

Bibliografía. Fontes de información

Basic Bibliography

Donald R. Askeland, Ciencia e ingeniería de los materiales, 6ª, Cengage Learning, 2012, México
William F. Smith, Fundamentos de la Ciencia e Ingeniería de los Materiales, 4ª, McGraw-Hill, 2014, México

Complementary Bibliography

A. Brent, Plastics. Materials and processing, 3ª, Pearson Prentice Hall, 2006, EEUU
J. Antonio Pero-Sanz, Ciencia e ingeniería de materiales. Estructura, transformaciones, propiedades y selección, 5ª, CIE-Dossat 200, 2000, Madrid
Michael F. Ashby, Materiales para ingeniería 1. Introducción a las propiedades, las aplicaciones y el diseño, 1ª, Reverté, 2008, Barcelona
Michael F. Ashby, Materiales para ingeniería 2. Introducción a la microestructura, el procesamiento y el diseño, 1ª, Reverté, 2009, Barcelona
Prasad, N.E., Aeroespace materials and Materials tecnologies, 1, Springer, 2017, The Netherlands

Recomendacións

Subjects that it is recommended to have taken before

Ciencia e tecnoloxía dos materiais/O07G410V01304
Resistencia de materiais e elasticidade/O07G410V01405
Fabricación aeroespacial/O07G410V01501
Materiais para a industria aeroespacial/O07G410V01903

IDENTIFYING DATA				
Systems in real time				
Subject	Systems in real time			
Code	O07G410V01904			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	The subject presents the requests of the systems in real time to the basic systems of control of flight in aerospace vehicles, as well as his application. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• Know How
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.	• Know How
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.	• Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know How

Learning outcomes	
Learning outcomes	Competences
Knowledge, understanding and application of the requests of the systems in real time to the basic systems of control of flight	CB2 CB3 CB5 CE24 CE31 CT11
Knowledge, understanding, application, analysis and synthesis of the systems in real time of control of the aerospace vehicles.	CB2 CB3 CB5 CE24 CE31 CT11

Contents
Topic
Reactive and real-time systems
Reliability and fault tolerance
Concurrent programming, synchronization and comunication
Human-machine interface
Real-time systems programming: real-time operating systems and synchronous/asynchronous programming
Simulation and verification of real-time systems

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	31	60	91
Laboratory practical	12	12	24
Mentored work	6	26	32
Introductory activities	1	0	1
Objective 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
Lecturing	The professor will present in the theoretical classes the contents of the subject. The students will have basic texts of reference for the follow-up of the subject.
Laboratory practical	Computer tools will be used to solve problems and exercises and apply the knowledge obtained in the theoretical classes, and the students will have to solve similar exercises to acquire the necessary capacities
Mentored work	Project developed by the student, and mentored by the teacher
Introductory activities	Activities aimed at contacting and gathering information about students, as well as presenting the subject.

Personalized assistance

Methodologies	Description
Introductory activities	The professor will personally answer the doubts and queries of the students. Questions will be addressed in person, especially in the classes of problems and laboratory and tutorials, as a non-contact, by the telematic systems available for the subject
Lecturing	The professor will personally answer the doubts and queries of the students. Questions will be addressed in person, especially in the classes of problems and laboratory and tutorials, as a non-contact, by the telematic systems available for the subject
Laboratory practical	The professor will personally answer the doubts and queries of the students. Questions will be addressed in person, especially in the classes of problems and laboratory and tutorials, as a non-contact, by the telematic systems available for the subject
Mentored work	The professor will personally answer the doubts and queries of the students. Questions will be addressed in person, especially in the classes of problems and laboratory and tutorials, as a non-contact, by the telematic systems available for the subject

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	(*)	20	CB2 CB3 CB5 CE24 CE31 CT11
Mentored work	(*)	40	CB2 CB3 CB5 CE24 CE31 CT11
Objective questions exam	(*)	40	CB2 CB3 CB5 CE24 CE31 CT11

Other comments on the Evaluation

The calendar of evaluation tests officially approved by the Xunta de Centro de la EEAE is published on the website http://aero.uvigo.es/gl/docencia/exames

The minimum mark to be reached in the final exam of continuous evaluation will be 4.0 to pass the subject. In the case of not reaching said grade, the final grade will be the result of the minimum of the average grade of CE and 4.0.

Extraordinary call Students who have not passed the subject in the ordinary call will take an extraordinary exam that will have the same format and the same requirements as the ordinary exam.

In the extraordinary evaluation, a three-part examination will be carried out that will mean the full evaluation score: short answer, long answer (development), and problems.

As a student of the University of Vigo, the Statute of the University Student, approved by Royal Decree 1791/2010 of December 30, establishes in its article 12, point 2d, that the university student has the duty to refrain from the use or cooperation in fraudulent procedures in the evaluation tests, in the works carried out or in official documents of the university . Therefore, the student is expected to have adequate ethical behavior. If unethical behavior is detected during the course (copy, plagiarism, use of unauthorized electronic devices or others), the student will be penalized with a grade of 0.0 in the written or deliverable test where such fraud is detected.

Sources of information
Basic Bibliography
Alan Burns, Andy Wellings, Sistemas de tiempo real y lenguajes de programación, 3ª, Prentice Hall, 1997,
Xiacong Fan, Real-Time Embedded Systems: design principles and engineering practices, 1ª, Newnes, 2018,
Jiacung Wang, Real-Time embedded systems, 1", Wiley & Sons, 2017,
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Meteorology				
Subject	Meteorology			
Code	O07G410V01905			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	de la Torre Ramos, Laura			
Lecturers	de la Torre Ramos, Laura Gimeno Presa, Luís Nieto Muñiz, Raquel Olalla			
E-mail	ltr@uvigo.es			
Web	http://aero.uvigo.es			
General description	Introduction to meteorology, the measurement of parameters, the instrumentation and its influence on the flight. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CE10	Understand how the aerodynamic forces determine the dynamics of the flight and the role of the different variables therein.	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge of the meteorological effects and its causes	CB2 CB3 CB5 CT11
Understanding of the usage and impact of meteorology on aircraft operations.	CB2 CB3 CB5 CE10 CT11
Understanding of the theoretical foundations of meteorological systems and instrumentation	CB2 CB3 CB5 CT11

Contents	
Topic	
Atmosphere and meteorology	atmospheric composition atmospheric structure vertical variation of pressure, temperature and density atmospheric layers according to the vertical temperature rate atmospheric layers by distribution of components the electrosphere the PBL meteors

Instrumentation and meteorological information	INSTRUMENTATION pressure, temperature, humidity, precipitation, wind, cloud height, cloud cover, visibility sounding satellite radar instruments in aeroplanes AERONAUTICAL METEOROLOGICAL INFORMATION aeronautical units OACI/ICAO organisation of the spanish aeronautical meteorological service AMA and AMDAR aeronautical climatologies meteorological reports/warnings (METAR, SPECI, TAF, SIGMET, GAMET, AIRMET, AIREP, SIGWX, airfield, lightning, storms) available meteorological information in the OMA
Thermodynamics	diagrams temperature and humidity variables levels in diagrams stability/inestability evolution of dry air evolution of wet air condensation in the atmosphere inestability indices
Wind	equation of movement horizontal flow without friction wind vertical variation wind structure in the PBL general circulation in the troposphere and middle atmosphere: near-surface, free atmosphere, stratosphere, mesosphere jets: tropical and extratropical local wind: sea and coastal breezes, valley and mountain, föhn effect impacts of meteorology on the flight: turbulence, shear, atmospheric waves
Clouds microphysics	Aerosols supercooled water warm clouds: nucleation, hydrometeors growth, fall, and split cold clouds: nucleation, hydrometeors growth, fall and melting, ice enhancement impacts of meteorology on the flight: icing, precipitation types
Convection	convective clouds formation single cell, multicell, supercell electricity (lightning and static electricity) convective systems arches in stormlines gusts fronts tornados cloud cells and cloud streets orographic convection impacts of the meteorology on the flight: electricity, downbursts
Visibility	factors that affect the visibility fog, mist, smoke, haze and smog fog and strata: radiation and adveccton fog, development conditions and maintenance duststorms impacts of the meteorology on the flight volcanic ashes
Depressions	airmass extratropical cyclones: types, cold, warm and occluded fronts, associated weather (visibility, turbulence, icing) tropical cyclones: regions and season of occurrence, development and maintenance conditions, extratropical transition DANA thermal and orographic laws

Meteorological prediction	numerical weather prediction: data control, computer resources, assimilation, parametrisation, ensembles, processing the model outputs, data interpretation, verification, downscaling, limited area models, nesting, initial conditions and forcings nowcast
Meteorology and space operations	Fundamental characteristics launching conditions reentry conditions influence in orbit

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	25	50
Computer practices	25	0	25
Practices report	0	28	28
Objective questions exam	2	20	22
Problem and/or exercise solving	0	25	25

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

Methodologies

	Description
Lecturing	Theoretical classes Exhibition of the main theoretical and practical contents using the computer and the blackboard. Tasks out of the classroom will be proposed in order to fix or expand the subject.
Computer practices	Seminars using computers. Personalised follow-up of the student during the class. Different exercises will be proposed in class and will be completed out of the classroom.

Personalized assistance

Methodologies	Description
Lecturing	The follow-up of the progress of the student will be performed during master class hours and tutoring hours, verifying that all the students have understood the bases and aims of the subject. Any problem that arise will be solved in situ in the classroom or during tutoring hours
Computer practices	The follow-up of the progress of the student will be performed during seminar hours in the classroom, verifying that all the students have understood and have learnt to make the calculations and interpretations associated. Any problem that arise will be solved in situ in the classroom or during tutoring hours.
Tests	Description
Practices report	The follow-up of the progress of the student will be performed during tutoring hours. Any problem that arise will be solved in situ in the classroom or during tutoring hours.
Problem and/or exercise solving	The follow-up of the progress of the student will be performed during tutoring hours. Any problem that arise will be solved in situ in the classroom or during tutoring hours.

Assessment

	Description	Qualification	Evaluated Competencess
Computer practices	Active participation in classes	10	CB2 CB3 CB5 CE10 CT11
Practices report	Preparation of a report that the student will have to deliver and, if necessary, defend.	30	CB2 CB3 CB5 CE10 CT11

Objective questions exam	Short answer questions on the theory and the resolution of two or three problems, also short, on the exercises during the seminars.	40	CB2 CB3 CB5 CE10 CT11
Problem and/or exercise solving	Evaluate the student's capacity for work as well as the results of said work, both for the tasks finished during the classes and for the homework	20	CB2 CB3 CB5 CE10 CT11

Other comments on the Evaluation

Continuous assessment:

To pass the subject it is compulsory to assist to, at least, 21 out of the 25 hours corresponding to the practices (seminars) and deliver all the tasks proposed.

It is also compulsory to take the exam and deliver the practices report

The student will have to reach at least half of the total score in each one of the tasks.

The dates of all the examinations convocatories are the officially approved and published in the web of the Centre.

Non-continuous assessment:

For exceptional cases

It is compulsory to deliver the practices report, as well as to take the exam, having to reach at least half of the total score in each one. In this case the score percentages are:

- 20% Practices report (seminars) (minimum score to pass the subject: 1 out of 2)
- 80% Exam (minimum score to pass the subject: 4 out of 8)

Second convocatory:

100% exam (minimum score to pass the subject: 5 out of 10).

In case of not taking or not passing the exam, the student will be evaluated of the same way that the rest of students in the following convocatories.

Extraordinary convocatory:

100% exam (minimum score to pass the subject: 5 out of 10).

In case of not taking or not passing the exam, the student will be evaluated of the same way that the rest of students in the following convocatories.

Dates of the exams:

The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

Sources of information

Basic Bibliography

J. V. Iribarne, W. L. Godson, Termodinámica de la atmósfera, Ministerio de Medioambiente, 1996,

Wallace, J.M. Y Hobbs, P, Atmospheric Science, Elsevier, 2006,

http://www.aemet.es/es/portada,

www.meted.ucar.edu/index.php,

Complementary Bibliography

Bohren, C. y Albrecht, B., Atmospheric Thermodynamics, Oxford University Press, 1998,

Houze, R.A, Cloud Dynamics, Academic Press, 1993,

www.zamg.ac.at/docu/Manual/SatManu/main.htm,

IDENTIFYING DATA				
Pilotless aircrafts				
Subject	Pilotless aircrafts			
Code	O07G410V01906			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Radar				
Subject	Radar			
Code	O07G410V01907			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Principles of laser for aerospace technology				
Subject	Principles of laser for aerospace technology			
Code	O07G410V01908			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Information and communication technology				
Subject	Information and communication technology			
Code	O07G410V01909			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Sistemas da xestión da información				
Subject	Sistemas da xestión da información			
Code	O07G410V01910			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Informática			
Coordinator	Campos Bastos, Celso			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	Introdución aos sistemas de información nas empresas con aspectos respecto á súa seguridade e ferramentas da súa xestión.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • saber facer
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• saber • saber facer
CE24	Coñecemento adecuado e aplicado á Enxeñaría de: Os sistemas das aeronaves e os sistemas automáticos de control de voo dos vehículos aeroespaciais.	• saber
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• Saber estar / ser

Resultados de aprendizaxe	
Learning outcomes	Competences
RA1: Comprensión, aplicación e análise dos sistemas de xestión da información en proxectos aeroespaciais.	CB2 CB3 CB5 CE24 CT11

Contidos	
Topic	
Información	- Codificación - Almacenamento - Procesamiento - Uso
Sistemas de Información	- Recursos informáticos - Ferramentas - Transmisión de información - Análise
Seguridade	- Ameazas e Contramedidas - Ciberseguridade - Protección de datos
Xestión	- Normas e Certificación - Estándares - Interoperabilidade - Interfaces entre aplicacións

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	18	36	54

Estudo de casos	20	30	50
Resolución de problemas	10	20	30
Actividades introdutorias	1	1.5	2.5
Exame de preguntas de desenvolvemento	2.5	5	7.5
Resolución de problemas e/ou exercicios	1	5	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	Exposición por parte do profesorado dos contidos sobre a materia obxecto de estudo, bases teóricas e/ou directrices dun traballo, exercicio ou proxecto a desenvolver polo/a estudante.
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.
Resolución de problemas	Resolver problemas e/ou exercicios relacionados coa materia. O/a estudante debe desenvolver unha solución acertada ou correcta e interpretar os resultados.
Actividades introdutorias	Actividades encamiñadas a organizar a materia, reunir fontes de información, así como a presentación do contido e planificación temporal.

Atención personalizada

Avaliación

	Description	Qualification	Evaluated Competencess
Estudo de casos	(*)Prueba en la que el alumno/a debe analizar un hecho, problema o suceso real con la finalidad de conocerlo, interpretarlo, resolverlo, generar hipótesis, contrastar datos, reflexionar, completar conocimientos, diagnosticarlo y adiestrarse en procedimientos alternativos de solución. Resultados de aprendizaje evaluados: RA1, RA3	10	CB2 CB3 CB5 CE24 CT11
Exame de preguntas de desenvolvemento	(*)Pruebas que incluyen preguntas abiertas sobre el contenido de la asignatura. Los alumnos/as deben desarrollar, relacionar, organizar y presentar los conocimientos que tienen sobre la materia en una respuesta argumentada. Resultados de aprendizaje evaluados: RA1, RA2, RA3, RA4	70	CB2 CB3 CB5 CE24 CT11
Resolución de problemas e/ou exercicios	(*)Entregas periódicas individuales o en grupo indicadas por el/la profesor/a que servirán de información sobre la marcha del/a estudiante y serán además indicadoras de su asistencia. Resultados de aprendizaje evaluados: RA3, RA4.	20	CB2 CB3 CB5 CE24 CT11

Other comments on the Evaluation

O sistema de avaliación na segunda edición de acta é a mesmo que en maio, mantendo, se procede, as cualificacións obtidas para a resolución de problemas, estudos de casos, e/ou exercicios e a asistencia e participación.

Estudantes non-asistentes a clases presenciais poden realizar un exame tanto en primeira como en segunda edición da acta que cobre 100% da nota final.

Datas de avaliación: o calendario de exames publícase na web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

Connolly, T.M.; Begg, C., Sistemas de bases de datos: un enfoque práctico para diseño, implementación y gestión, 4, Pearson Educación, 2005,

Elena Ruiz Larrocha, Nuevas tendencias en los sistemas de información, Editorial Universitaria Ramón Areces, 2017,

Complementary Bibliography

Recomendacións

IDENTIFYING DATA				
Advanced communication systems for aerospace vehicles				
Subject	Advanced communication systems for aerospace vehicles			
Code	O07G410V01911			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Systems applied to aerospace design				
Subject	Systems applied to aerospace design			
Code	O07G410V01912			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Tecnoloxías para conformado de materiais aeroespaciais				
Subject	Tecnoloxías para conformado de materiais aeroespaciais			
Code	O07G410V01913			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Deseño na enxeñaría			
Coordinator	Pereira Domínguez, Alejandro Pérez García, José Antonio			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	Esta materia presenta unha introdución á enxeñaría e á industrialización do produto cun enfoque práctico e moderno á fabricación de compoñentes aeroespaciais e á enxeñaría de procesos.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• Saber estar / ser
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• Saber estar / ser
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• Saber estar / ser
CE12	Comprender os procesos de fabricación.	• 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 • saber facer
CE30	Coñecemento adecuado e aplicado á Enxeñaría de: As prestacións tecnolóxicas, as técnicas de optimización dos materiais utilizados no sector aeroespacial e os procesos de tratamentos para modificar as súas propiedades mecánicas.	• saber
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• Saber estar / ser

Resultados de aprendizaxe	
Learning outcomes	Competences
O/a estudante coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación.	CB2 CB3 CB5 CE12 CE19 CE30 CT11
O/a estudante coñece toda a información necesaria para levar a cabo un proceso de produción.	CB2 CB3 CB5 CE12 CE19 CE30 CT11
O/a estudante é capaz de realizar un informe que permita a execución exitosa dun proceso de produción.	CB2 CB3 CB5 CE12 CE19 CE30 CT11

Coñecer adecuadamente e de forma aplicada á enxeñaría as prestacións tecnolóxicas, as técnicas de optimización dos procesos de fabricación con materiais utilizados no sector aeroespacial para modificar as súas propiedades funcionais mecánicas.	CB2 CB3 CB5 CE12 CE19 CE30 CT11

Contidos	
Topic	
01 - Enxeñaría de produto	01 - Deseño de Produto 02 - Elaboración de prototipos 03 - Validación de produto 04 - Planificación do proceso de fabricación
02 - Industrialización do produto	05 - Aplicación de ferramentas CAM na Simulación do proceso de fabricación 06 - Deseño e elaboración de utillaxes de fabricación e manutención 07- Deseño e elaboración de utillaxes de control 08- Deseño de embalaxes
03 - Fabricación de compoñentes aeroespaciais	09 - Conformado de Materiais compostos 10 - Conformado de Polimeros 11 - Conformado de Aliaxes metálicas aeroespaciais 12 - Conformado de materiais cerámicos
04 - Enxeñaría de procesos	13 - Automatización 14 - Monitorización do rendemento 15 - Mellora de procesos 16 - Industria 4.0 no sector aeroespacial

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	6	12	18
Aprendizaxe colaborativa	6	12	18
Aprendizaxe baseado en proxectos	26	52	78
Traballo tutelado	6	12	18
Saídas de estudo	7	0	7
Proxecto	1	10	11
*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	(*)Indicaciones básicas de contenidos. Se hará referencia a bibliografía, publicaciones y desarrollos. Descripción de casos
Aprendizaxe colaborativa	(*)Se fomentará el trabajo en equipo de los alumnos
Aprendizaxe baseado en proxectos	(*)El objetivo prioritario de este curso será el aprendizaje adquirido mediante el diseño y desarrollo de producto/proceso, que se realizará en función de los medios disponibles, aplicando contenidos, técnicas y resolución de problemas, adquiridos en teoría y práctica
Traballo tutelado	(*)El alumno será supervisado por el profesor en las distintas etapas de elaboración del Proyecto de la asignatura. Para ello se establecerán varios puntos de seguimiento y control de la evolución del trabajo realizado
Saídas de estudo	(*)Dependiendo de la disponibilidad y numero permitido de personas por visita se realizarían viajes a empresas del sector aeronáutico.

Atención personalizada	
Methodologies	Description
Lección maxistral	Prestarase atención ao alumnado tanto no horario lectivo como nas titorías.
Aprendizaxe baseado en proxectos	Prestarase atención ao alumnado tanto no horario lectivo como nas titorías.
Aprendizaxe colaborativa	Prestarase atención ao alumnado tanto no horario lectivo como nas titorias.
Traballo tutelado	Prestarase atención ao alumnado tanto no horario lectivo como nas titorias.

Avaliación		
Description	Qualification	Evaluated Competencess

Traballo tutelado	(*)A lo largo del curso el alumno realizará un trabajo que recopila los conocimientos que le fueron aportados a lo largo del curso. El trabajo consistirá en el diseño y fabricación de un componente relacionado con el sector aeroespacial	100	CB2 CB3 CB5 CE12 CE19 CE30 CT11

Other comments on the Evaluation

PRIMEIRA EDICIÓN DE ACTA: A materia avalíase en base a un único parámetro: Traballo da materia (nota máxima 10 puntos) Aprobarán a materia aqueles estudantes que consigan unha nota igual ou superior a 5 puntos.

SEGUNDA e SUCESIVAS EDICIÓNS DE ACTA: O método de avaliación é o mesmo que o descrito para a PRIMEIRA EDICIÓN DE ACTA.
OUTRAS CONSIDERACIÓNS: Os traballos serán entregados o día do exame da materia. En caso de discrepancia entre o contido da Guia Docente nas súas versións en Castelán, Galego e Inglás, prevalecerá o establecido na versión en Castelán.
O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

John G. Nee, Fundamentals of Tool Design, 6, SME, 2010,

T. Black, R. Kohser, Degarmo´s Materials and Processes in Manufacturing, 12, Wiley, 2017,

Tickoo, Sham, Catia v5-6 R2014 for designers, 12, Shererville IN: CADCIM Technologies, 2015,

Kalpakjian, Manufactura, Ingenieria y Tecnología, 7, Pearson Education, 2014,

Recomendacións

Subjects that it is recommended to have taken before

Fabricación aeroespacial/O07G410V01501

IDENTIFYING DATA				
Cartography and geodesy				
Subject	Cartography and geodesy			
Code	O07G410V01914			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Application of microcontrollers in aerospace systems				
Subject	Application of microcontrollers in aerospace systems			
Code	O07G410V01915			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Embedded electronic instrumentation				
Subject	Embedded electronic instrumentation			
Code	O07G410V01916			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator				
Lecturers				
E-mail				

----- UNPUBLISHED TEACHING GUIDE -----

IDENTIFYING DATA				
Mecánica de sólidos e estruturas aeronáuticas				
Subject	Mecánica de sólidos e estruturas aeronáuticas			
Code	O07G410V01921			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3	1c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Comesaña Piñeiro, Rafael Conde Carnero, Borja			
Lecturers	Bendaña Jácome, Ricardo Javier Comesaña Piñeiro, Rafael Conde Carnero, Borja			
E-mail	bconde@uvigo.es racomesana@uvigo.es			
Web	http://faitic.uvigo.es/index.php/es/			
General description	Introdución á mecánica de sólidos e as estruturas aeronáuticas			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber facer
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado	
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.	• saber • saber facer
CE26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.	• saber • saber facer
CE33	Coñecemento aplicado de: aerodinámica; mecánica do voo, enxeñaría da defensa aérea (balística, mísiles e sistemas aéreos), propulsión espacial, ciencia e tecnoloxía dos materiais, teoría de estruturas.	• saber • saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• Saber estar / ser
CT5	Capacidade de resolución de problemas e toma de decisións	• Saber estar / ser
CT6	Capacidade de comunicación interpersoal	• Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• Saber estar / ser
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• Saber estar / ser

Resultados de aprendizaxe	
Learning outcomes	Competences
Compresión das ecuacións e principios xerais do medio continuo, así como a axeitada selección dos diferentes modelos de compartamento de sólidos deformables	CB2 CE26 CE33 CT4 CT5 CT11
Análise de sólidos e estruturas sometidas a tensións superiores ao límite elástico e a cargas cíclicas	CB3 CB4 CE20 CT4 CT6 CT8 CT11

Coñecemento, comprensión, aplicación, análise e síntese da teoría de estruturas	CB3 CB4 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Coñecemento dos aspectos máis destacados do comportamento estrutural de aeronaves	CB2 CB3 CE20 CE26 CE33 CT4 CT5 CT8

Contidos	
Topic	
Introdución ás características e configuración das estruturas aeronáuticas	- Cargas sobre a estrutura. - Elementos estruturais. Estrutura da fuselaxe: monocasco, semimonocasco. Estrutura de ala e de cola.
Estruturas simétricas.	- Estruturas simétricas.
Esforzos producidos polo momento flector e pola forza cortante.	- Teorema do fluxo cortante. - Esforzos cortantes. - Flexión composta en estruturas simétricas.
Torsión.	- Seccións non circulares. Sección rectangular. - Seccións abertas de pequeno espesor. Seccións cerradas de pequeno espesor. Seccións cerradas multicelulares. - Centro de torsión. - Flexión-torsión.
Análise de tensións en alas.	- Análise de tensións en alas.
Análise de tensións en fuselaxes.	- Análise de tensións en fuselaxes.
Introducción á integridade estrutural	- Requisitos de resistencia e rixidez. Factor último de seguridade. - Fatiga. Criterios de fatiga basados en tensións. - Criterios de fatiga basados en deformacións. - Introdución á mecánica da fractura. Criterios de tolerancia ao dano. Marxe de seguridade e factor de reserva.
Elementos sometidos a esforzos axiais de tracción e momentos flectores.	- Elementos sometidos a esforzos axiais de tracción e momentos flectores. Momento flector último.
Problemas de inestabilidade	- Introducción á teoría da estabilidade. - Pandeo global. Inestabilidade primaria de columnas de sección estable. - Pandeo de viga-columna. Esforzo de crippling. - Inestabilidade de paneles planos e curvos. - Pandeo local de vigas de sección de parede delgada. - Paneles rixidizados. Formas de fallo a compresión e cortadura.
Unións en estruturas aeronáuticas.	- Unións en estruturas aeronáuticas.
Teoría de placas e láminas.	- Elementos estructurais tipo placa e lámina. - Hipóteses básicas de cálculo. - Flexión de placas e láminas. - Pandeo de placas.
Método dos elementos finitos (MEF).	- Análise estática lineal con elementos tipo barra, elasticidade 2D e 3D, placas e láminas. - Introdución a software de simulación MEF. - Inestabilidade estrutural. Pandeo mediante MEF. - Introducción á análise estática non-lineal de estruturas: non-linealidade xeométrica, non-linealidade do material (plasticidade), non-linealidade debida ás condicións de contorno.

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	40	0	40
Resolución de problemas	10	0	10
Prácticas de laboratorio	24	10	34

Resolución de problemas de forma autónoma	0	120	120
Exame de preguntas de desenvolvemento	3.5	17.5	21

*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 na aula dos coñecementos básicos da materia.
Resolución de problemas	Resolución de problemas relacionados cos contidos teóricos.
Prácticas de laboratorio	Realización de prácticas no laboratorio e/ou realización de prácticas en aula informática e/ou resolución de problemas prácticos
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios de forma autónoma por parte do alumno

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	Nas prácticas intentarase na medida do posible atender personalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas

Avaliación

	Description	Qualification	Evaluated Competencess
Prácticas de laboratorio	Asistencia e participación activa nas clases prácticas. Resolución de problemas e/ou exercicios de forma autónoma.	10	CB2 CB3 CE20 CE26 CE33 CT3 CT4 CT5 CT8 CT11
Exame de preguntas de desenvolvemento	Realizarase un examen ao final do curso sobre a totalidade do contido abordado na materia.	90	CB2 CB4 CE20 CE26 CE33 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

Para superar a materia na avaliación da 1ª convocatoria e na 2ª convocatoria requerirase obter unha calificación superior a 5 puntos sobre 10 na valoración conxunta da avaliación continua durante o desenvolmento das clases e o examen na data oficial. A calificación final obterase de acordo ás porcentaxes indicadas.

O calendario de probas de avaluación aprobado oficialmente pola Xunta de Centro da EEAE publícase na web:http://aero.uvigo.es/gl/docencia/exames
A duración máxima do examen será de 3 horas se non hai interrupción ou de 5 horas se hai unha pausa intermedia (sendo 3 horas o máximo para cada parte).

Estudantes que renuncien oficialmente á avaliación continua: a nota será obtida no exame correspondente que representará o 100% da calificación. Este examen poderá constar dunha parte a realizar en aula informática e/ou laboratorio cunha calificación que representará o 10% da calificación total.

Bibliografía. Fontes de información

Basic Bibliography

E. de la Fuente Tremps, Introducción al análisis de las Estructuras Aeronáuticas, 1ª, Garceta, 2014,

T. H. G. Megson, Aircraft Structures for engineering students, 4ª, Elsevier, 2003,

Eugenio Oñate Ibáñez de Navarra, Cálculo de estructuras por el método de elementos finitos, CIMNE, 1995,

Complementary Bibliography

S.P. Timoshenko, Theory of plates and shells, 1ª, McGraw Hill, 1940,

R. Bendaña, Ejercicios de Resistencia de Materiales y cáculo de Estructuras para Ingenieros, 1ª, Galiza Editora, 2005,

Darrol Stinton, The anatomy of the aeroplane., 1ª, BPS Profesional Book, 1985,

John Cutler, Understanding Aircraft Structures, 1ª, Blackwell Science, 1992,

Bruce K. donalson, Analysis of Aircraft Structures, 1ª, McGRAW-HILL. International Editions, 1993,

Recomendacións

Subjects that it is recommended to have taken before

Expresión gráfica: Expresión gráfica/O07G410V01105
Física: Física I/O07G410V01103
Física: Física II/O07G410V01202
Matemáticas: Álxebra lineal/O07G410V01102
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201
Ciencia e tecnoloxía dos materiais/O07G410V01304
Matemáticas: Estatística/O07G410V01401
Mecánica clásica/O07G410V01305
Resistencia de materiais e elasticidade/O07G410V01405
Termodinámica/O07G410V01303

IDENTIFYING DATA				
Mecánica de fluídos II e CFD				
Subject	Mecánica de fluídos II e CFD			
Code	O07G410V01922			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Martín Ortega, Elena Beatriz			
Lecturers	Martín Ortega, Elena Beatriz Rodríguez Pérez, Luis			
E-mail	emortega@uvigo.es			
Web	http://aero.uvigo.es			
General description	Coñecemento, compresión e aplicación de conceptos e técnicas da Mecánica de Fluídos de Enxeñaría Aeroespacial Parte de la asignatura se presenta como una introducción a la dinámica de fluidos computacional que, partiendo de un conocimiento de las ecuaciones de conservación de los fluidos (ya adquirido por los alumnos en asignaturas previas) permita al alumno realizar simulaciones sencillas que involucren a un fluido como medio de trabajo.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • saber facer
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• saber • saber facer
CE16	Coñecemento adecuado e aplicado á Enxeñaría de: Os conceptos e as leis que gobernan os procesos de transferencia de enerxía, o movemento dos fluídos, os mecanismos de transmisión de calor e o cambio de materia e o seu papel na análise dos principais sistemas de propulsión aeroespaciais.	• saber • saber facer
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 • saber facer
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 • saber facer
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.	• saber • saber facer
CE22	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en todos os réximes, para determinar as distribucións de presións e as forzas sobre as aeronaves.	• saber • saber facer
CE25	Coñecemento adecuado e aplicado á Enxeñaría de: os métodos de cálculo de deseño e proxecto aeronáutico; o uso da experimentación aerodinámica e dos parámetros máis significativos na aplicación teórica; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación, deseño, análise e interpretación de experimentación e operacións en voo; os sistemas de mantemento e certificación de aeronaves.	• saber • saber facer
CE26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.	• saber • saber facer
CE28	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en calquera réxime e determinan as distribucións de presións e as forzas aerodinámicas.	• saber • saber facer
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber facer • Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber facer • Saber estar / ser

CT5	Capacidade de resolución de problemas e toma de decisións	• saber facer
CT6	Capacidade de comunicación interpersoal	• saber facer • Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• saber facer • Saber estar / ser
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• saber facer • Saber estar / ser

Resultados de aprendizaxe

Learning outcomes	Competences
Coñecemento e comprensión dos principais conceptos e técnicas da Mecánica de Fluídos	CB3 CE16 CE18 CE19 CE22 CE28 CT4 CT5 CT8 CT11
Capacidade para aplicar os principais conceptos e técnicas da Mecánica de Fluídos ás Ciencias da Enxeñaría	CB2 CB3 CB5 CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11
Comprensión dos procedementos básicos da dinámica de fluídos computacional	CB5 CE16 CE18 CE19 CE22 CE25 CE26 CE28 CT4 CT5 CT8 CT11

Contidos

Topic	
CFD. Ecuacións xerais e fenómenos de transporte	Tema 1: Resumo das ecuacións xerais. Notación integral Notación diferencial Forma conservativa. Notación compacta Modelos límite máis comúns Condicións de contorno máis comúns

CFD. Turbulencia	Tema 2: Introdución á turbulencia Introdución Escala de Kolmogorov Inviabilidad da simulación numérica directa Modelos de turbulencia: Modelos RANS: -Medias de Reynolds e de Favre -Ecuacións promediadas. Esforzos aparentes de Reynolds. Problema do peche - Hipótese de Boussinesq: modelos algebraicos, dunha ecuación e de dúas ecuacións - Leis de parede. Modelos de alto e baixo número de Reynolds - Modelos de transporte de esforzos aparentes de Reynolds Modelos LLES: Descrición
CFD. Introdución á dinámica de Fluídos Computacional	Tema 3: Métodos FVM de resolución numérica das ecuacións de Navier-Stokes. Métodos de Volumes Finitos (FVM): - Introdución - Discretización do dominio computacional - Discretización das ecuacións de fluídos - Ecuacións discretizadas en FVM - Discretización das condicións de contorno Fluxos incompresibles. Ecuación de presión - Métodos de compresibilidad artificial - Axustes presión-velocidade - Métodos de aceleración da resolución numérica máis comúns Tema 4: Introdución ao uso de distintos software (OpenFoam e Fluent) de simulación numérica de fluídos. Prácticas en aula informática. *O uso deste software quedará condicionado á dispoñibilidade de licenzas de uso por parte do centro así como á correcta instalación dos mesmos na aula informática asignada Aplicacións: - Fluxo laminar no interior dunha cavidade - Fluxo nun dispositivo mesturador de correntes - Forzas aerodinámicas sobre corpos: Fluxo ao redor dun obstáculo. Fluxo laminar e fluxo turbulento Cálculo da rúa de Kármán tras un corpo romo Fluxo incompresible sobre perfil aerodinámico Fluxo transónico sobre perfil aerodinámico -Exercicios/Proxectos propostos de simulación numérica para ser resoltos de forma máis independente polos alumnos.

Mecánica de Fluídos II. Fluxo de fluídos ideais. Movementos irrotacionais	Tema 1: Movementos irrotacionais. Condicións de irrotacionalidad Ecuacións do movemento irrotacional Condicións iniciais e de contorno Movemento irrotacional de líquidos Principio de superposición Potencial de velocidades a grandes distancias dun obstáculo Movemento plano irrotacional de líquidos: Solucións elementais. Corrente en recunchos e esquinas. Corrente ao redor dun cilindro con circulación Movemento irrotacional bidimensional de gases Expansión de Prandtl-Meyer Tema 2: Movementos con superficies de discontinuidad Ecuacións do salto das magnitudes fluídas nunha discontinuidad Discontinuidades normais e tangenciales Ondas de choque normais Ondas de choque *oblicuas Aplicación: Movemento case *unidimensional de fluídos ideais: Área crítica. Movemento en *toberas. Carga e descarga en depósitos. Ondas de choque. Relación de *Hugoniot.
Mecánica de Fluídos II. Movementos unidimensionales non estacionarios de fluídos ideais	Tema 3: Movemento unidimensional non estacionario de fluídos ideais. Efecto de compresibilidad na líquidos Apertura e peche de válvulas. Golpe de ariete Ecuacións do movemento unidireccional non estacionario en gases. Ondas simples
Mecánica de Fluídos II. Movemento a baixos números de Reynolds	Tema 4: Movemento a baixos números de Reynolds Ecuacións. Condicións iniciais e de contorno Aplicación a fluídos incompresibles. Movementos ao redor dun cilindro e unha esfera Lubricación: Ecuación de Reynolds da lubricación 3D. Aplicacións. cojinete cilíndrico, lubricación con gases, patín rectangular, ...
Mecánica de Fluídos II. Capa límite	Tema 5: Capa límite laminar Capa límite laminar incompresible. Solucións de semellanza. Capa límite sobre placa plana. Solución de Blausius Capa límite laminar compresible Capa límite térmica a baixas velocidades
Mecánica de Fluídos II. Prácticas de laboratorio	- Ensaio en banco de aerodinámica: Medición capa límite - Ensaio en túnel de vento de baixa velocidade Distribución de presións sobre perfil aerodinámico Distribución de presións sobre corpo romo - Distribución de presións en toberas converxentes e converxentes-diverxentes. Magnitudes críticas. Ondas de choque. Bloqueo sónico. *A realización desta práctica quedará condicionada á dispoñibilidade do equipo experimental na data de realización da mesma

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	4.5	5	9.5
Lección maxistral	35	35	70
Aprendizaxe baseado en proxectos	8	17	25
Prácticas en aulas informáticas	8	0	8
Resolución de problemas	19.5	73	92.5
Proxecto	0	15	15
Exame de preguntas de desenvolvemento	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
Prácticas de laboratorio	Realización das prácticas de laboratorio
Lección maxistral	Exposición da teoría Translación de problemas de fluídos a modelos matemáticos para ser resoltos numericamente
Aprendizaxe baseado en proxectos	Formulación e resolución numérica de problemas propostos aplicados a fluxos de fluídos
Prácticas en aulas informáticas	Formulación e resolución de modelos aplicados a fluxos de fluídos
Resolución de problemas	Resolución de problemas e/ou exercicios de forma autónoma por parte do alumno para comprender e caracterizar os distintos tipos de movementos de fluídos e os seus simplificaciones

Atención personalizada	
Methodologies	Description
Prácticas de laboratorio	Atenderase persoalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas
Resolución de problemas	Atenderase, na medida do posible, a todas as dúbidas que xurdan ao longo da resolución dos problemas
Prácticas en aulas informáticas	Nas prácticas tentarase na medida do posible organizar ao grupo de estudantes en distintas prácticas. Atenderase persoalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas
Tests	Description
Proxecto	Atenderase en tutorías as dúbidas que xurdan ao longo do desenvolvemento do proxecto

Avaliación			
	Description	Qualification	Evaluated Competencess
Prácticas de laboratorio	Asistencia e participación activa nas prácticas	1.5	CB2 CB3 CB5 CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11

Resolución de problemas	Asistencia ás sesións de resolución de problemas e entrega dos problemas propostos	2	CB2 CB3 CB5 CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11
Aprendizaxe baseado en proxectos	Realización e entrega de informe das simulacións propostas ao alumno	20	CB2 CB3 CB5 CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11
Prácticas en aulas informáticas	Asistencia e participación activa nas prácticas	1.5	CB2 CB3 CB5 CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11

Exame de preguntas de desenvolvemento	Realización de probas escritas, incluíndo o exame final da materia	75	CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28 CT3 CT5

Other comments on the Evaluation

Primeira edición da acta:
A avaliación da materia realizarase mediante:

- Proba ou probas escritas, incluída o exame escrito final (75% da nota final).
- Entrega do Proxecto/s (de simulación numérica) propostos ao alumnado polo profesorado (20% da nota final na materia). Esta entrega forma parte da avaliación continua da materia
- terase en conta a asistencia e participación activa nas clases prácticas, de laboratorio e informáticas así como a entrega de problemas propostos polo profesorado nas clases prácticas e/ou teóricas si así o indica (5% da nota final na materia). Esta porcentaxe forma parte da avaliación continua

Os estudantes que non cursen a materia pola modalidade de avaliación continua, realizarán un exame final de 5h de duración (con descanso no medio) que suporá o 100% da súa nota

Segunda edición da acta:

- A nota do proxecto de simulación numérica gardarase para a segunda edición da acta.
- A nota de avaliación continua asociada a lle asistencia e participación activa e entrega de problemas propostos polo profesorado (si así o indica) gardarase para a segunda edición da acta.
- O resto da nota será un exame escrito.
- No caso dos estudantes que non teñan nota na avaliación continua na primeira convocatoria este exame final da segunda edición da acta representará o 100% da súa nota e contará con preguntas relacionadas con todo o temario da materia

Bibliografía. Fontes de información

Basic Bibliography

White, F.M, Viscous fluid flow, 3rd ed., McGraw-Hill, 2006,

Panton, R. L., Incompressible Flow, 4th Edition, Wiley, 2013,

Anderson, Modern Compressible Flow, 3nd Ed., Mc Graw Hill, 1992,

BARRERO & PÉREZ-SABORID, Fundamentos y aplicaciones de la Mecánica de Fluidos, Mc Graw Hill, 2005,

BLAZEK, J., Computacional Fluid Dynamics: Principles and Applications, Elsevier, 2001,

H K Versteeg and W Malalasekera, An Introduction to Computational Fluid Dynamics THE FINITE VOLUME METHOD, 2nd Ed., Prentice Hall, 2007,

Complementary Bibliography

Kundu , C., Fluid Mechanics, 4th Edition,, Academic Press, 2010,

SCHLICHTING, H, Boundary Layer Theory, Mc Graw Hill, 1987,

FERZIGER, J., MILOVAN, P., Computational Methods for fluid Dynamics,, Springer, 1999,

F. Moukalled L. Mangani M. Darwish, The Finite Volume Method in Computational Fluid Dynamics An Advanced Introduction with OpenFOAM® and Matlab®, Springer, 2016,

WILCOX, Turbulence Modeling, DCW Industries, 2004,

www.openfoam.com,

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Métodos matemáticos/O07G410V01301
Mecánica de fluídos/O07G410V01402

IDENTIFYING DATA				
Aerodynamics and aeroelasticity				
Subject	Aerodynamics and aeroelasticity			
Code	O07G410V01923			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Navarro Medina, Fermín			
Lecturers	Navarro Medina, Fermín			
E-mail	fermin.navarro.medina@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject includes the aerodynamic forces that determine the dynamics of the flight and the role of the different variables involved in the aerodynamic phenomena of profiles, wings, and nozzles, considering both compressible and incompressible flow. An introduction to aeroelasticity is also made. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CE20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.	• know • Know How
CE22	Appropriate knowledge applied to engineering: foundations of fluid mechanics that describe the flow in all regimes, to determine the distributions of pressures and forces on an aircraft.	• know • Know How
CE25	Appropriate knowledge applied to engineering: methods of design calculations and aeronautical projects; use of aerodynamic experimentation and the most significant parameters in the theoretical application; management of experimental techniques, equipment and measuring instruments; simulation, design, analysis and interpretation of experimentation and operations in flight; systems of maintenance and certification of aircrafts.	• know • Know How
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.	• know • Know How
CE28	Appropriate knowledge applied to engineering: foundations of fluid mechanics that describe the flow in any regime and determine the distribution of pressures and aerodynamic forces.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be

Learning outcomes	
Learning outcomes	Competences

- Knowledge, understanding, application and analysis of the aerodynamic phenomena and of the laws that govern his behaviour; - Knowledge, understanding and synthesis of the foundations of the flight of the aircraft - Knowledge, understanding, application, analysis and synthesis of the methods applied to the study of aeroelasticity; - Knowledge, understanding, application, analysis and synthesis of the aeroelasticity of a profile, from the static point of view (problems of torsional divergence and of investment of control) and dynamic (problems of flutter and buffet) - Knowledge, understanding, application, analysis and synthesis of aeroelasticity of one-dimensional and two-dimensional structures.; - Knowledge and understanding of the most important appearances of experimental aeroelasticity, and more specifically of the essays in earth and in flight of aerostructures	CB2 CB3 CB5 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5 CT6 CT8 CT11

Contents

Topic	
1. Aerodynamics of uncompressible flow	Subject 1.1: Introduction Subject 1.2: Foundations and principles of the aerodynamic Subject 1.3: Foundations of the uncompressible flow Subject 1.4: Uncompressible flow on airfoils Subject 1.5: Uncompressible flow on finite wings Subject 1.6: Three-dimensional uncompressible flow
2. Aerodynamics of compressible flow	Subject 2.1: Foundations of the compressible flow Subject 2.2: Waves of crash Subject 2.3: compressible Flow in nozzles and diffusing Subject 2.4: linear Theory of compressible flow in airfoils
3. Aeroelasticity	Subject 3.1: Introduction to aeroelasticity Subject 3.2: Aeroelasticity of airfoil and one-dimensional structures Subject 3.3: Aeroelasticity of two-dimensional structures Subject 3.4: Experimental aeroelasticity

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	0	15
Previous studies	0	126.5	126.5
Seminars	4	0	4
Problem solving	20	0	20
Workshops	6	0	6
Lecturing	30	0	30
Objective questions exam	3.5	0	3.5
Practices report	0	20	20

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

Methodologies

	Description
Laboratory practical	Realisation of a practice programmed using the wind tunnel and the hot thread cutting machinne and other processes of manufacture. The realisation of the practice requires the preparation of the same by means of a previous design, the assistance to the sessions of practices and the realisation of a report by part of the group of students.
Previous studies	Study of the student of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university
Seminars	The seminars consist in the realisation of exercises in groups of students and individually, that will have to resolve during the time of the seminar. So much the conjoint resolution of the exercise, like the individual contribution will be valued. They will make two asset seminars during the course.
Problem solving	Resolution of problems and/or exercises that treat punctual appearances of the contents of the course, developed by the professor and/or the students in the classroom
Workshops	Workshop of software of aerodynamic simulation, whose utilisation serves of support for the rest of the subject, so much for the resolution of problems, as for the preparation of the practices.
Lecturing	Exhibition of a subject or resolution of problems by part of the professor according to a previously established script

Personalized assistance

Methodologies	Description

Previous studies	The student studies of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university
Workshops	Workshop of software of aerodynamic simulation, whose utilisation serves of support for the rest of the subject, so much for the resolution of problems, as for the preparation of the practices. The workshop will be guided by the professor of the subject.

Assessment

	Description	Qualification	Evaluated Competencess
Seminars	The seminars consist in the realisation of exercises in groups of students and individually, that will have to resolve during the time of the seminar. So much the conjoint resolution of the exercise, like the individual contribution will be valued. They will make two asset seminars during the course.	20	CB2 CB3 CE20 CE22 CE26 CE28 CT3 CT4 CT5 CT6 CT8
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the subject	60	CB2 CB3 CB5 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT5
Practices report	Report of the works made in the laboratory, and of the design of the profile and the wing.	20	CB2 CB3 CB5 CE20 CE22 CE25 CE26 CE28 CT3 CT4 CT6 CT11

Other comments on the Evaluation

Continuous assessment

To pass the subject in the evaluation in the 1st call will be required to obtain a grade higher than 5 points out of 10 in the joint assessment of the continuous evaluation during the development of the classes and the exam on the official date.

The official exam grade must be greater than 5 points out of 10.

The final grade will be obtained according to the percentages indicated.

The evaluation testing calendar officially approved by the EEAE Center Board is published on the web http://aero.uvigo.es/gl/docencia/exames

The maximum duration of the exam will be 3 hours if there is no interruption or 5 hours if there is an intermediate break (3 hours maximum for each part).

Extraordinary exam

The student must submit to the extraordinary exam of all the contents of the subject, which will be 100% of the grade, if the final grade of continuous assessment is less than 5 points out of 10.

You will also have to take the ordinary exam in the following cases :- The non-performance or delivery of any of the points of the continuous evaluation.

- Obtain a grade below 5 points out of 10 in the final exam of continuous evaluation.

Sources of information

Basic Bibliography

John D. Anderson Jr, Fundamentals of Aerodynamics, McGraw-Hill Education, 2016,
John J. Bertín, Aerodynamics for engineers, Pearso, 2013,
Raymond L. Bisplinghoff, Principles of Aeroelasticity, Dover Books, 2013,

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Fluid mechanics II and CFD/O07G410V01922

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Fluid mechanics/O07G410V01402

IDENTIFYING DATA				
Mechanics of flight				
Subject	Mechanics of flight			
Code	O07G410V01924			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Navarro Medina, Fermín			
Lecturers	Navarro Medina, Fermín			
E-mail	fermin.navarro.medina@uvigo.es			
Web	http://aero.uvigo.es			
General description	Flight mechanics include the study of the performance, stability, and static and dynamic control of aerospace vehicles (focusing on fixed-wing aircraft in this course), as well as flight qualities and tests. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.	• know
CE23	Appropriate knowledge applied to engineering: physical phenomena of flight, its qualities and its control, aerodynamics, propulsive forces, active control and stability.	• know • Know How
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.	• know • Know How
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.	• know • Know How
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• Know How • Know be
CT4	Capability of autonomous learning and information management	• Know be
CT5	Capability to solve problems and draw decisions	• Know be
CT6	Capabiliity for interpersonal communication	• Know How • Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know be
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge of the most stood out appearances of the qualities of flight and the essays in flight of the aircraft	CB5 CG6 CE23 CE33 CT8 CT11
Knowledge, understanding, application, analysis and synthesis of the performances, the stability and controlabilidad static and dynamic of the aircraft.	CB2 CB3 CE26 CE31 CT3 CT4 CT5 CT6

Contents	
Topic	
1. Introduction to the mechanics of flight.	1.1. Introduction to the mechanics of flight. 1.2. Systems of reference and angles in mechanics of flight. 1.3. General equations of the movement.
2. Performances of gliders and aeroplanes propulsados by aerorreactores and by alternative engines.	2.1. Performances of gliders 2.2. Performances of aeroplanes propulsados by aerorreactores in horizontal rectilinear flight 2.3. Performances of aeroplanes propulsados by aerorreactores in another type of flights 2.4. Performances of aeroplanes propulsados by alternative engines 2.5. Performances in takeoff and landing
3. Stability and static and dynamic control	3.1. Stability and longitudinal static control 3.2. Stability and lateral static control-directional 3.3. Introduction to the stability and dynamic control
4. Introduction to the Qualities of Flight and to the Essays in Flight.	4.1. Introduction to the Qualities of Flight and to the Essays in Flight.

Planning			
	Class hours	Hours outside the classroom	Total hours
Problem solving	15	0	15
Lecturing	28	0	28
Autonomous problem solving	0	97.5	97.5
Mentored work	4	0	4
Problem and/or exercise solving	3	0	3
Objective 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
Problem solving	Resolution of problems and/or exercises that treat punctual appearances of the contents of the subject, developed by the professor and/or the students in the classroom.
Lecturing	Exhibition of a subject by part of the professor according to a previously established script
Autonomous problem solving	Study of the student of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university
Mentored work	The work tutelado consists in the preparation of a project of design of an aircraft using the concepts learnt during the subject of mechanics of flight. It will be necessary on the other hand review key ideas of the subject of aerodynamics and aeroelasticidad. The work is of preparation grupal.

Personalized assistance	
Methodologies	Description
Mentored work	The work tutelado consists in the preparation of a project of design of an aircraft using the concepts learnt during the subject of mechanics of flight. It will be necessary on the other hand review key ideas of the subject of aerodynamics and aeroelasticidad. The work is of preparation grupal.
Autonomous problem solving	Study of the student of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university

Assessment		
Description	Qualification	Evaluated Competencess

Mentored work	The work tutelado consists in the preparation of a project of design of an aircraft using the concepts learnt during the subject of mechanics of flight. It will be necessary on the other hand review key ideas of the subject of aerodynamics and aeroelasticidad. The work is of preparation grupal.	25	CB2 CB3 CB5 CG6 CE23 CE26 CE31 CE33 CT4 CT5 CT6 CT8 CT11
Problem and/or exercise solving	Approach of problems to study and resolve in the classroom on the contents of the subject, to make by the student individually and/or in group	15	CB2 CB3 CB5 CG6 CE23 CE26 CE31 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the subject	60	CB2 CB3 CB5 CG6 CE23 CE26 CE31 CE33 CT3 CT4 CT5 CT8 CT11

Other comments on the Evaluation

Continuous assessment

To surpass the subject in the first assessment is required to obtain a mark upper to 5 points on 10 in the average mark of the continuous assessment during the development of the classes and the examination in the official date. The mark of the examination in official date has to be upper to 5 points on 10. The final mark will be calculated according to the percentages indicated. The scored activities of the continuous assessment will take place during the lecturing hours of the subject, so that it requires the regular attendance to the classes by part of the students.

The calendar of proofs of assessment approved officially by the Board of Centre EEAE is published in the web

http://aero.uvigo.es/gl/docencia/exames

The maximum duration of the examination will be 3 hours if there is not interruption, or of 5 hours if there is an intermediate

pause (being a maximum of 3 hours for each part).

Extraordinary examination

The student has to attend to the extraordinary examination of all the contents of the subject, that will be 100% of the mark, if the final mark of continuous assessment is lower that 5 points on 10. Besides, they have to attend the extraordinary examination in the following cases:

- They did not make or deliver any of the scored activities of the continuous assessment inside the terms and dates established.

- They obtained an mark lower than 5 points over 10 in the final examination of continuous assessment .

Sources of information

Basic Bibliography

Gómez Tierno M.A., Pérez Cortés M., and Puentes Márquez C., Mecánica del vuelo, 2, Ibergarceta Publicaciones S.L., 2012, España

Complementary Bibliography

PHILLIPS W., Mechanics of Flight, 2, John Wiley & Sons Ltd, 2009, Reino Unido

Hull D.G., Fundamentals of Airplane Flight Mechanics, 1, Springer, 2007, Alemania

Recommendations

Subjects that it is recommended to have taken before

Aerodynamics and aeroelasticity/O07G410V01923

IDENTIFYING DATA				
Systems engineering and aerospace communications				
Subject	Systems engineering and aerospace communications			
Code	O07G410V01925			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Isasi de Vicente, Fernando Guillermo			
Lecturers	Isasi de Vicente, Fernando Guillermo			
E-mail	fisasi@uvigo.es			
Web	http:// aero.uvigo.es			
General description	Introduction to the engineering of systems and to the systems of communications with aerospace vehicles. 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
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• Know How
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• Know How
CT2	Leadership, initiative and entrepreneurship	• Know be
CT3	Capability of oral and written communication in native lenguage	• Know be
CT4	Capability of autonomous learning and information management	• Know How
CT5	Capability to solve problems and draw decisions	• 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
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know be

Learning outcomes	
Learning outcomes	Competences
- Understanding of the concept of engineering of systems. - Understanding, knowledge and application of the national and international standards applied to the aerospace engineering. - Compression, knowledge of the systems of communications in aerospace vehicles	CB3 CB5 CG1 CG4 CE19 CT2 CT3 CT4 CT5 CT6 CT8 CT13

Contents	
Topic	
Concept of Engineering of Systems	Need of an engineering of systems. Simple examples
Standard nations and Internaciones of Engineering of Systems in Aerospace projects	Study of the most used standards in: aerial Systems spatial Systems common Points
Application to national and international projects of Engineering of Systems.	Examples: aerial System: commercial aerial navigation spatial System: nano-hammer satellites
Introduction	Basic concepts of aerial navigation and communications
Direction finding	Principles Applications
VOR	Principle of operation Description Use
DME/TACAN	Principle of operation Description Use
ILS	Principle of operation Description Use
Primary radar	Principle of operation Description Use
Secondary radar	Principle of operation Description Use
GPS	Principle of operation Description Use
Augmented reality systems	Principle of operation Description Use

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	30	75	105
Laboratory practical	20	22	42
Problem and/or exercise solving	3	0	3

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

Methodologies	
	Description
Lecturing	Lecture with help of blackboard and computer. These lectures treat about the theory of the subject. With this methodology work the competitions CG1, CG4, CB3, CB5, CE19, CT8 and CT5. This is a grupal activity.
Laboratory practical	Use of simulators of systems of communications and/or navigation. Use of basic tools in the engineering of systems. With this methodology work the competitions CG1, CG4, CB3, CE19, CT2, CT4, CT5, CT6, CT11 and CT13. It is a grupal.activity.

Personalized assistance	
Methodologies	Description
Lecturing	Students can use tutorization time at professor's office. Tutorization timetable is published at faculty's web page at course start.
Laboratory practical	In the practices of laboratory the student can ask professor to resolve doubts. Beside, the students can make use of tutorization timeat professor's office. The schedule for tutorization at professor's office established at the start of course and it is published at faculty's web page.

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	(*)Preguntas de o profesor sobre a marcha e avaliación de o traballo de laboratorio.	20	CB5 CG1 CG4 CE19 CT4 CT5 CT6 CT8 CT13
Problem and/or exercise solving	(*)Exame de resolución de problemas e/ou preguntas breves sobre a materia explicada en as clases magistrales. Faranse dous exames de avaliación continua durante o curso: un a metade de curso en o que se preguntará polo que se deu ata o momento. O peso de este exame será de 40% de a nota final. Para os alumnos que obteñan un 3/10 ou máis haberá un segundo exame antes de acabar o curso con un 40% de peso e as mesmas condicións que o anterior. Si o alumno non obtivo máis de 3/10 en os dous exames, con unha media superior a 5/10 ou ben desexe mellorar nota presentándose ao final, poderá facelo en o día fixado por a escola para os exames de a asignatura.	80	CB3 CB5 CG1 CG4 CE19 CT4 CT5 CT8

Other comments on the Evaluation

In the case that a student failed more than 20% of practice sessions, he / she will not be able to pass the subject by continuous evaluation. The second edition of the minutes will evaluate the whole subject. In the case that he / she prefers and has done laboratory practices and obtained more than a 3/10 in them, the student can do only the theoretical part. This theoretical part weighs 80% of the mark, the other 20% will be the mark obtained during the course. If the student has not practiced, they may be asked in a written exam or in the laboratory, weighing the mark of practices by 20% and the theory of 80%. Students who officially resign to the continuous assessment, the mark obtained in a corresponding exam will represent 100% of the qualification. The evaluation test calendar officially approved by the EEAE Center Board is published on the website http://aero.uvigo.es/gl/docencia/exames

Sources of information

Basic Bibliography

Alexander V. NebylovJoseph Watson, Aerospace Navigation Systems, 1, WIley, 2016,

ETSIA/EUITA/EIAE, Sistemas y Equipos electrónicos para la navegación aérea, 1, ETSIA/EUITA/EIAE, Madrid

Complementary Bibliography

NASA, System engineering handbook, Rev. 1, https://www.nasa.gov/sites/default/files/atoms/files/nasa_systems_engineering_handbook.pdf

Benjamin S. Blanchard, SYSTEM ENGINEERING MANAGEMENT, 5, Wiley, 2016,

Recommendations

IDENTIFYING DATA				
Aerorreactores e motores alternativos aeronáuticos				
Subject	Aerorreactores e motores alternativos aeronáuticos			
Code	O07G410V01931			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3	1c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	García Seoane, Santiago			
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	Coñecemento básico do funcionamento dos sistemas de propulsión empregados na industria aeroespacial.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • saber facer
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• saber • 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 • saber facer
CG7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.	• saber • saber facer
CE21	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos de sustentabilidade, mantenibilidad e operatividade dos vehículos aeroespaciais.	• saber • saber facer
CE23	Coñecemento adecuado e aplicado á Enxeñaría de: Os fenómenos físicos do voo, as súas cualidades e o seu control, as forzas aerodinámicas, e propulsivas, as actuacións, a estabilidade.	• 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 • saber facer
CT6	Capacidade de comunicación interpersoal	• saber • saber facer
CT8	Capacidade de razoamento crítico e autocrítico	• saber • saber facer
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• saber • saber facer
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos	• saber • saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences

- Coñecer as necesidades propulsivas das aeronaves.	CB2
- Coñecer empúxelos e resistencias relacionados cos aerorreactores.	CB3
- Coñecer e cuantificar de forma aplicada o proceso de combustión dos aerorreactres e o rendemento da combustión.	CB5 CG1
- Saber realizar un balance enerxético diferenciando e calculando os rendementos involucrados.	CG7
- Saber resolver problemas relacionados co cálculo dos ciclos termodinámicos e as características dos aerorreactores; así como o efecto das características e calidade dos compoñentes.	CE21 CE23
- Coñecer os diferentes aerorreactores e saber obter os sistemas óptimos baixo o punto de vista de propulsivo.	CT3 CT4
- Dimensionar os compoñentes que interveñen en sistema propulsivo.	CT6
- Utilizar ferramentas informáticas de cálculo de actuacións de aerorreactores	CT8
- Coñecer o efecto das condicións de voo: velocidade e altitude no funcionamento dos aerorreactores	CT11
- Coñecer os problemas ambientais dos aerorreactores e as súas posibles solucións	CT13
- Redactar informes técnicos e facer exposicións orais técnicas relacionadas co anterior	
- Resolver problemas derivados do ámbito da materia de forma autónoma e en colaboración con outro	
- Coñecemento, comprensión, aplicación, análise e síntese da influencia de parámetros de operación e deseño sobre as actuacións dos motores alternativos aeronáuticos e os seus sistemas	
- Coñecemento dos aspectos máis destacados dos ensaios dos motores alternativos	

Contidos

Topic
- Necesidades propulsivas das aeronaves
- Análises do ciclo dun aerorreator
- Aplicación das ecuacións integrais da Mecánica de Fluídos aos Aerorreactores: continuidade: gasto másico; Cantidade de movemento: empuxes e resistencias; Enerxía: rendementos
- Comportamento motor e propulsor dos aerorreactores.
- Turbohélices e a súa optimización
- Turbofanes e a súa optimización; turbofanes de fluxo mesturado; turbofanes avanzados
- Sistemas incrementadores de empuxe
- Turbinas de gas
- Actuacións de compoñentes
- Actuacións de aerorreactores
- Problemas ambientais derivados do funcionamento dos aerorreactores.
- Elementos construtivos do motor alternativo.
- Ciclos
- Renovación de carga
- Alimentación de combustible.
- Combustión
- Sobrealimentación
- Turboalimentación
- Actuacións

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	20	0	20
Estudo previo	0	89.5	89.5
Lección maxistral	30	0	30
Exame de preguntas obxectivas	2.5	0	2.5
Informe de prácticas	0	8	8

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

Metodoloxía docente

	Description
Prácticas de laboratorio	Prácticas informáticas, saídas de estudo e prácticas de laboratorio
Estudo previo	Preparación para o seguimento da materia, procura de información e preparación das probas de avaliación.
Lección maxistral	Docencia en aula con apoio audiovisual

Atención personalizada

Tests	Description

Exame de preguntas obxectivas	
Informe de prácticas	

Avaliación

	Description	Qualification	Evaluated Competencess
Exame de preguntas obxectivas	(*)Examen de preguntas cortas y solución de problemas	90	CB2 CB3 CB5 CG1 CG7 CE21 CE23 CT3 CT4 CT8 CT11 CT13
Informe de prácticas	(*)Informe de las prácticas	10	CB2 CB3 CB5 CG1 CG7 CE21 CE23 CT3 CT4 CT6 CT8 CT11 CT13

Other comments on the Evaluation

Para superar a materia na avaliación da 1ª edición da acta e na 2ª edición da acta requerirase obter una calificación superior a 5 puntos sobre 10 na valoración conxunta da avaliación continua durante o desenvolvemento das clases e o examen da data oficial. A cualificación final obterase de acordo ás porcentaxes indicadas.

O calendario de probas de avaliación aprobado oficialmente por la Xunta de Centro da EEAE publícase na web

http://aero.uvigo.es/gl/docencia/exames

A duración máxima do examen será de 3 horas se non hai interrupción ou de 5 horas se hai unha pausa intermedia (sendo 3 horas máximo para cada parte).

Estudantes que renuncien oficialmente á avaliación continua: a nota será obtida nun exame correspondente que representará o 100% da cualificación. Este examen poderá constar dunha parte a realizar en aula informática e/ou laboratorio cunha cualificación que representará o 30% da cualificación total.

Bibliografía. Fontes de información

Basic Bibliography

Caludio Mataix, Turbomaquinas Termicas, Dossat Ediciones, 2011,

Francisco Payri y Jose María Desantes, Motores de combustión interna alternativos, Editorial Reverte, 2011,

BORJA GALMÉS BELMONTE, Motores de reacción y turbinas de gas, Ediciones Paraninfo, 2015,

Complementary Bibliography

Jack D. Mattingly, Elements of Propulsion: Gas Turbines and Rockets, AIAA Education Series, 2006,

Oates, Gordon C, Aerothermodynamics of gas turbine and rocket propulsion, AIAA education series, 1997,

Recomendacións

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103
Física: Física II/O07G410V01202
Química: Química/O07G410V01203
Tecnoloxía aeroespacial/O07G410V01205
Mecánica de fluídos/O07G410V01402
Termodinámica/O07G410V01303

IDENTIFYING DATA				
Deseño mecánico, MEF e vibracións				
Subject	Deseño mecánico, MEF e vibracións			
Code	O07G410V01932			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3	2c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Losada Beltrán, José Manuel			
Lecturers	Losada Beltrán, José Manuel			
E-mail	jlosada@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia introduce ao deseño mecánico, o método de elementos finitos e o estudo das vibracións.			

Competencias		
Code		Typology
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo	• saber • saber facer • Saber estar / ser
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética	• saber • saber facer • Saber estar / ser
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía	• saber • saber facer • Saber estar / ser
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 • saber facer • Saber estar / ser
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 • Saber estar / ser
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.	• saber • saber facer • Saber estar / ser
CE22	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en todos os réximes, para determinar as distribucións de presións e as forzas sobre as aeronaves.	• saber • saber facer • Saber estar / ser
CE25	Coñecemento adecuado e aplicado á Enxeñaría de: os métodos de cálculo de deseño e proxecto aeronáutico; o uso da experimentación aerodinámica e dos parámetros máis significativos na aplicación teórica; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación, deseño, análise e interpretación de experimentación e operacións en voo; os sistemas de mantemento e certificación de aeronaves.	• saber • saber facer • Saber estar / ser
CT3	Capacidade de comunicación oral e escrita na lingua nativa	• saber • saber facer • Saber estar / ser
CT4	Capacidade de aprendizaxe autónoma e xestión da información	• saber • saber facer • Saber estar / ser

CT5	Capacidade de resolución de problemas e toma de decisións	• saber • saber facer • Saber estar / ser
CT6	Capacidade de comunicación interpersoal	• saber • saber facer • Saber estar / ser
CT8	Capacidade de razoamento crítico e autocrítico	• saber • saber facer • Saber estar / ser
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos	• saber • saber facer • Saber estar / ser

Resultados de aprendizaxe	
Learning outcomes	Competences
Coñecemento, comprensión e aplicación de elementos mecánicos.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Coñecemento dos aspectos máis destacados das calidades dos Sistemas mecánicos: modos de fallo e fiabilidade.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Capacidade para identificar e resolver problemas mecánicos.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11

Comprensión do método dos elementos finitos.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Resolución de problemas relativamente complexos en mecánica de medios continuos mediante a selección do modelo de comportamento e da formulación adecuada para o mesmo.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Coñecemento, comprensión, aplicación, análise e síntese dos métodos aplicados ao estudo da resposta de aeronaves fronte a cargas non estacionarias.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Coñecemento, comprensión, aplicación, análise e síntese dos sistemas vibratorios dun grao de liberdade, de múltiples graos de liberdade e continuos.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11

Coñecemento, comprensión, aplicación, análise e síntese dos métodos aproximados de cálculo para os sistemas continuos.	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11

Contidos

Topic	
FUNDAMENTOS DO DESEÑO MECANICO	-INTRODUCIÓN.DEFINICIÓN DE MAQUINA, MECANISMO E CADEA CINEMÁTICA.ESAQUEMATIZACIÓN, MODELIZACIÓN E SIMBOLOXÍA. SÍNTESE ESTRUTURAL E DIMENSIONAL.PARES CINEMATICOS.ECUACIÓNS DE LIGADURA.GRAOS DE LIBERDADE. -ANALISIS DE CARGA E ESFORZO ESFORZO.CIRCULO DE MOHOR ESFORZO PLANO ESFURZO UNIFORMEMENTE DISTRIBUÍDO ESFORZOS NORMAIS PARA VIGAS EN FLEXIÓN.VIGAS CURVAS. ESFORZOS DE CONTACTO.
ANALISIS DA VIBRACIÓN	-FUNDAMENTOS. -VIBRACIÓNS LONGITUDINALES E TORSIONALES:1,2 G.L. APLICACIÓNS TÉCNICAS DOS SISTEMAS DE 1 E 2 G.L. -VIBRACIÓNS DE N G.L. -ANALISIS MODAL. -RESPOSTA A EXCITACIÓNS DINAMICAS XERAIS. -ANALISIS DE FOURIER E RESPOSTA NA FRECUENCIA. -MEDIDA DA VIBRACION. -SISTEMAS CONTINUOS.VIBRACIÓNS LONGITUDINALES, TORSIONALES E TRANSVERSAIS.DETERMINACION DAS PULSACIONES PROPIAS
VIBRACION ALEATORIA	-ESCITACIONES NON DETERMINISTICAS. -PROPIEDADES ESTADISTICAS. -CORRELACION. -DENSIDADE DE POTENCIA EXPECTRAL. -RESPOSTA DUN SISTEMA. -DEFORMACIÓN EFICAZ. -DESEÑO MECÁNICO
DESEÑO, CONTROL E MANTEMENTO BASEADO NA VIBRACION	-EXCITACIÓNS DETERMINÍSTICAS -EXCITACIÓNS NON DETERMINÍSTICAS -FONTES DE VIBRACIÓN. -ELIMINACIÓN DA VIBRACIÓN. -REDUCIÓN DA TRANSMISIBILIDAD. -ABSORBEDORES DINÁMICOS. -ENXEÑARÍA DO EQUILIBRADO.FUNDAMENTOS DO EQUILIBRADO ESTÁTICO E DINÁMICO. -MÉTODOS ESPECTRALES. -MÉTODOS ESTATÍSTICOS. -MANTEMENTO PREDICTIVO.
METODO DOS ELEMENTOS FINITOS	-FUNDAMENTOS. -GEOMETRIA DO ELEMENTO -COORDENADAS NODALES. -ECUACIÓNS E DEFINICION DE ELEMENTOS. -CONECTIVIDAD ENTRE ELEMENTOS. -GENERACION DE MALLA. -IMPOSICION DE LIGADURAS. -DETERMINACION DA MATRIZ INERCIA, ELASTICA E AMORTIGUAMIENTO. -ANALISIS DA VIBRACION.

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	39	26	65
Prácticas de laboratorio	40	120	160

*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	CLASE MAXISTRAL NA QUE SE EXPOÑEN Os CONTIDOS TEORICOS-PRACTICOS POR MEDIOS TRADICIONAIS (LOUSA) E RECURSOS MULTIMEDIA.
Prácticas de laboratorio	REALIZACION DE TAREFAS PRACTICAS EN LABORATORIO DOCENTE

Atención personalizada

Methodologies	Description
Lección maxistral	leccións maxistrais
Prácticas de laboratorio	exercicios dos contidos

Avaliación

	Description	Qualification	Evaluated Competencess
Lección maxistral	AVALIACIÓN DOS COÑECEMENTOS ADQUIRDOS MEDIANTE UN EXAME TEÓRICO-PRÁCTICO	70	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11
Prácticas de laboratorio	AVALÍASE A REALIZACIÓN DAS MEMORIAS DE PRÁCTÍCAS REALIZADAS NO CURSO.	30	CB2 CB3 CB5 CG1 CG2 CE20 CE22 CE25 CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

A MATERIA SE APROBA SE SE OBTEN UNHA CUALIFICACIÓN IGUAL OU MAIOR QUE UN CINCO COMO NOTA FINAL, DA SEGUINTE FORMA:

1.- A ASISTENCIA AO LABORATORIO, AS MEMORIAS DE CADA PRÁCTICA E TRABALLOS TUTELADOS TERÁN UNHA VALORACIÓN DE 3 PUNTOS DA NOTA FINAL, ESTA CALIFICACION SE CONSERVA NA SEGUNDA EDICIÓN DA ACTA.

2.- O EXAME FINAL TERÁ UNHA VALORACIÓN DE 7 PUNTOS NA NOTA FINAL.

No caso de non asistentes, o 100% da nota corresponderá a un exame final no que se avaliarán as competencias da materia.

Compromiso ético:

Se espera que o alumnado exhiba un comportamento ético axeitado. No caso de detectar un compartamento non ético (copia, plaxio, uso de dispositivos electrónicos non autorizados e outros) considerarase que o estudante non cumpre os requisitos necesarios para superar a materia. Neste caso, suspenderase a cualificación global no curso académico actual (0).

O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

SHIGLEY, DISEÑO EN INGENIERIA MECANICA, OCTAVA, McGrawHill, 2008, ESPAÑOL

SINGERESU S. RAO, VIBRACIONES MECANICAS, QUINTA, PEARSON, 2012, ESPAÑOL

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Expresión gráfica: Expresión gráfica/O07G410V01105
Física: Física II/O07G410V01202
Informática: Informática/O07G410V01104
Matemáticas: Cálculo II/O07G410V01201
Ciencia e tecnoloxía dos materiais/O07G410V01304

IDENTIFYING DATA				
Aerospace Vehicles				
Subject	Aerospace Vehicles			
Code	O07G410V01933			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The space vehicles operate in a very different environment than the earth. This environment is critical when defining the design requirements of the space vehicles. In addition to the space environment, it is under the scope of this subject the study of the necessary concepts of orbital mechanics for the understanding of the main application orbits, maneuvers and perturbations of the space vehicles. Main subsystems of a space vehicle are studied, as well, with special attention to the subsystem of thermal control and the subsystem of attitude control. Labs are included using specific material and simulation software of mission analysis. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.	• know • Know How
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know be

Learning outcomes	
Learning outcomes	Competences

- Knowledge, understanding, application and analysis of the basic configurations, subsystems and missions of the space vehicles	CB2 CB3
- Capacity for the analysis of the mission, of the type of law of guided and space path	CB5
- Knowledge, understanding, application and analysis of the thermal control of the space vehicle	CG1
- Knowledge, understanding, application and analysis of control of attitude and orbit of the space vehicle	CG6
- Knowledge and understanding of the system of essays and of the support of earth of the space vehicle	CE24 CT3 CT4 CT6 CT11 CT13

Contents

Topic	
BLOCK 1: Introduction	Lesson 1.1: Brief historical review. Lesson 1.2: Classification of space vehicles Lesson 1.3: Types of subsystems of space vehicles Lesson 1.4: The solar system. Lesson 1.5: The space and planetary surroundings.
BLOCK 2: Orbital Mechanics	Lesson 2.1: Systems of reference and time. Time laws and orbital elements Lesson 2.2: The two-body problem Lesson 2.3: you Trace, coverage and visibility Lesson 2.4: Perturbations Lesson 2.5: Types of orbits Lesson 2.6: The three-body problem
BLOCK 3: Analysis of mission	Lesson 3.1: space Maneuvers Lesson 3.2: Geocentric missions Lesson 3.3: Lunar and interplanetary missions
BLOCK 4: Subsystems	Lesson 4.1: Propulsion systems and launch vehicles Lesson 4.2: Space vehicles structures Lesson 4.3: System of attitude control Lesson 4.4: System of thermal control Lesson 4.5: Electrical , communications, commando and telemetry systems Lesson 4.6: Ground segment Lesson 4.7: Laboratory tests

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Laboratory practical	12	0	12
Seminars	0	2	2
Previous studies	0	79.5	79.5
Objective questions exam	2.5	0	2.5
Practices report	0	6	6
Essay	10	10	20

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

Methodologies

	Description
Lecturing	Classroom lecture
Laboratory practical	Practicum with different subsystems of space vehicles Practicum of simulation of analysis of mission Essays and reports about space vehicles
Seminars	Tutorials in small groups
Previous studies	Autonomous work

Personalized assistance

Methodologies	Description
Seminars	Tutorials in small groups.

Assessment

	Description	Qualification	Evaluated Competencess
Objective questions exam	Partial examination of short questions and problems (20%) final Examination of short questions and problems (50%)	70	CB2 CB3 CB5 CG1 CG6 CE24 CT3 CT4 CT11 CT13
Practices report	Report of the laboratory practices	10	CB2 CB3 CB5 CG1 CG6 CE24 CT3 CT4 CT6 CT11 CT13
Essay	Reports and presentations of essays and assignment proposed along the course during the practicum sessions	20	CB2 CB3 CB5 CG1 CG6 CE24 CT3 CT4 CT6 CT11 CT13

Other comments on the Evaluation

To pass the subject in in the first and second exam calls it is necessary to obtain an average grade of 5 points over 10 in the required evaluation of ongoing assessment during the year and official exam (scheduled by school). The final grade is computed using the percentages indicated. The calendar of evaluation tests is approved officially by the Board of the EEAE School and it is uploaded to the webiste: http://aero.uvigo.es/gl/docencia/exames

It will be mandatory to take the extraordinary exam of all the contents of the subject, which will be 100% of the grade, in the following cases:

- The non-execution or delivery of any of the previous points.

- Obtain a grade below 4 points out of 10 in the final continuous assessment exam.

The maximum length of the tests is 3 hours if there is not interruption or 5 hours if there is an intermediate pause (with 3 hours as maximum time for each part).

Students that resign officially to the ongoing assessment: the grade obtained in a corresponding test which is represents 100% of assessment. This test could have a part to be made in computer classroom and/or laboratory representing 10% of the final grade.

Sources of information

Basic Bibliography

H.D. Curtis, Orbital Mechanics for Engineering Students, ELSEVIER, 2014,
P. Fortescue, Spacecraft Systems Engineering, 4, Wiley, 2011,
M.D. Griffin y J.R. French, Space Vehicle Design, AIAA Education Series, 2004,
Charles Brown, Elements of Spacecraft design, AIAA Education Series, 2002,

Complementary Bibliography

Bong Wie, Space vehicle Dynamics and Control., AIAA Education Series, 1998,
R. Karam, Satellite Thermal Control for Systems Engineers, AIAA Education Series, 1998,

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Aerospace technology/O07G410V01205
Classical mechanics/O07G410V01305

IDENTIFYING DATA				
Fixed-wing and rotary wing aircrafts				
Subject	Fixed-wing and rotary wing aircrafts			
Code	O07G410V01934			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
Web	http://aero.uvigo.es			
General description	Design of fixed and rotary wing aircraft, and their typology, calculation methods, stability, control and systems. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How • Know be
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How • Know be
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How • Know be
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.	• know • Know How • Know be
CE25	Appropriate knowledge applied to engineering: methods of design calculations and aeronautical projects; use of aerodynamic experimentation and the most significant parameters in the theoretical application; management of experimental techniques, equipment and measuring instruments; simulation, design, analysis and interpretation of experimentation and operations in flight; systems of maintenance and certification of aircrafts.	• know • Know How • Know be
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.	• know • Know How • Know be
CT3	Capability of oral and written communication in native lenguage	• know • Know How • Know be
CT4	Capability of autonomous learning and information management	• know • Know How • Know be
CT6	Capabiliity for interpersonal communication	• know • Know How • Know be
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How • Know be
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know How • Know be

Learning outcomes	
Learning outcomes	Competences

- Knowledge, understanding, application, analysis and synthesis of the methods of calculation of design and project of aircraft of fixed wing	CB2 CB3 CE24 CE25 CT3 CT4 CT6 CT8
- Knowledge applied of the systems of the aircraft	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT4 CT6 CT8 CT11
- Knowledge, understanding, application, aerodynamics of the rotors, performance and stability and controllability of aircraft of the rotary wing aircraft	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT6 CT8
- Knowledge of the most stood out appearances of the qualities of flight and the essays in flight of the aircraft of rotatory wings	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT4 CT6 CT8 CT11

Contents
Topic
Unit 1. Types of fixed-wing aircraft
Unit 2. Methods of calculation of design and project
Unit 3. Architecture and design of components (fuselages, wings, stabilizing surfaces, landing gear, etc.)
Unit 4. Systems
Unit 5. Aerodynamics of rotors (Vertical Flight and Flight of Advance)
Unit 6. Performances of rotary wing aircraft
Unit 7. Introduction to the stability and controllability of rotary wing aircraft
Unit 8. Introduction to Flight Qualities and Flight Tests of rotary wing aircraft

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	30	68	98
Mentored work	22.5	45	67.5
Laboratory practical	22.5	22.5	45
Seminars	3.5	7	10.5
Essay questions exam	2	0	2
Presentation	0.5	1.5	2

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

Methodologies	
	Description
Lecturing	Presentation by the teacher of the contents on the subject under study, theoretical and / or guidelines for a job, exercise or project to be developed by the student.
Mentored work	The student, individually or in groups, prepares a paper on the subject of matter or prepare seminars, research, memoirs, essays, summaries of readings, lectures, etc.. Generally it is an autonomous activity of the student that includes finding and collecting information, reading and literature management, writing ...
Laboratory practical	Activities application of knowledge to specific situations and basic skills acquisition and related procedural matter under study. They are developed in specific spaces with specialized equipment (Laboratories, computer rooms, etc ...)
Seminars	Activity focused on the work on a specific topic, which allows to deepen or complement the contents of the subject. They can be used as a complement to the theoretical classes.

Personalized assistance	
Methodologies	Description
Lecturing	In the field of tutorial action, academic tutoring actions are distinguished, as well as personalized tutoring. In the first case, the students will have at their disposal hours of tutorials in which they can consult any doubt related to the contents, organization and planning of the subject, with the development of the project, etc. The tutorials can be individualized, but group tutoring will be encouraged to solve problems related to the activities to be carried out in groups, or simply to inform the teacher of the evolution of the collaborative work. In the personalized tutorials, each student, individually, can discuss with the teacher any problem that is preventing him from properly monitoring the subject, in order to find some types of solution between them. By combining both types of tutorial action, it is intended to compensate the different learning rhythms through attention to diversity.
Mentored work	In the field of tutorial action, academic tutoring actions are distinguished, as well as personalized tutoring. In the first case, the students will have at their disposal hours of tutorials in which they can consult any doubt related to the contents, organization and planning of the subject, with the development of the project, etc. The tutorials can be individualized, but group tutoring will be encouraged to solve problems related to the activities to be carried out in groups, or simply to inform the teacher of the evolution of the collaborative work. In the personalized tutorials, each student, individually, can discuss with the teacher any problem that is preventing him from properly monitoring the subject, in order to find some types of solution between them. By combining both types of tutorial action, it is intended to compensate the different learning rhythms through attention to diversity.

Assessment			
	Description	Qualification	Evaluated Competencess
Laboratory practical	Laboratory practice memory	25	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT4 CT8
Essay questions exam	Performing partial tests and a final continuous assessment exam	50	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT4

Presentation	Presentation in class of the group work developed.	25	CB2 CB3 CB5 CE24 CE25 CE26 CT3 CT4 CT6 CT8 CT11

Other comments on the Evaluation

The minimum grade to be reached in the final continuous assessment exam will be 4.0 in order to pass the subject.
The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.
In the case of not reaching said grade, the final grade will be the result of the minimum of the average score of EC and 4.0.
Extraordinary call Students who have not passed the subject in the ordinary call will perform an extraordinary exam that will have the same format and the same requirements as the ordinary exam. In the extraordinary evaluation, an examination in three parts will be carried out that will suppose the complete score of the evaluation: short answer, long answer (development), and problems.
As a student of the University of Vigo, the Statute for University Students, approved by Royal Decree 1791/2010 of December 30, establishes in its article 12, point 2d, that the university student has the duty to "abstain from the use or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university ". Therefore, it is expected that the student has an adequate ethical behavior. If unethical behavior is detected during the course (copying, plagiarism, use of unauthorized electronic devices or others), the student will be penalized with a grade of "0.0" in the written or deliverable test where said fraud was detected.

Sources of information

Basic Bibliography

Lloyd R. Jenkinson, James F. Marchman III, Aircraft Design Projects, Butterworth-Heinemann, 2003,
David W. Hall, P.E., Aircraft Conceptual And Preliminary Design, San Luis Obispo California, 2000,
Darrol Stinton, The Design Of The Airplane, Granada Publishing,
Alejandro Roger Ull, Diseño de helicópteros y aeronaves diversas, Universitat Politècnica de Catalunya,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Aerodynamics and aeroelasticity/O07G410V01923

IDENTIFYING DATA				
Maintenance and certification of aerospace vehicles				
Subject	Maintenance and certification of aerospace vehicles			
Code	O07G410V01935			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	Airworthiness is the ability of aircraft to fly. This quality is ensured through certification, which is made up of a set of tasks that guarantee that the aircraft is in safe conditions for the flight. To ensure that these conditions are maintained over time, we must speak of continuing airworthiness, that is, all the revisions, modifications and maintenance tasks necessary to maintain airworthiness over time. This subject deals with the procedures that affect airworthiness, basically analyzing the EASA and FAA regulations. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG3	Installation, operation and maintenance in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, infrastructures and airports, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CE21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.	• know • Know How
CE25	Appropriate knowledge applied to engineering: methods of design calculations and aeronautical projects; use of aerodynamic experimentation and the most significant parameters in the theoretical application; management of experimental techniques, equipment and measuring instruments; simulation, design, analysis and interpretation of experimentation and operations in flight; systems of maintenance and certification of aircrafts.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• know • Know be

Learning outcomes

Learning outcomes	Competences
- Knowledge, understanding, application, analysis and synthesis of aircraft certification and maintenance methods. - Applied knowledge of simulation, design, analysis and synthesis of experimentation and flight operations.	CB2 CB3 CB5 CG3 CG4 CE21 CE25 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Contents

Topic
- Organizations competent in matters of airworthiness - Airworthiness requirements. Types of certificates - Design and maintenance criteria - Aircraft certification codes and operations - Specification and modification of aircraft - Testing during certification and test flights.
- Fundamentals of aeronautical maintenance - Regulatory framework in relation to maintenance - Types of maintenance and tasks - Guarantee of quality and human factors in maintenance

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	33	0	33
Laboratory practical	20	0	20
Seminars	3.5	0	3.5
Previous studies	0	126	126
Objective questions exam	2.5	0	2.5
Practices report	0	10	10
Essay	20	10	30

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

Methodologies

	Description
Lecturing	Classroom lectures
Laboratory practical	Labs using different testing techniques Conducting certification practices Case studies of accident investigation
Seminars	Tutoring in small groups
Previous studies	Autonomous work

Personalized assistance

Methodologies	Description
Seminars	Tutoring in small groups

Assessment

Description	Qualification	Evaluated Competencess

Objective questions exam	Partial eliminatory exam Certification of short questions and problems (40%) Final exam Maintenance of short questions and problems (40%) * * In case of having a grade lower than 4 in the first eliminatory exam, the exam must be done again on the date of the final exam.	80	CB2 CB3 CB5 CG3 CG4 CE21 CE25 CT3 CT4 CT5 CT8 CT11 CT13
Practices report	Labs report	10	CB2 CB3 CB5 CG3 CG4 CE21 CE25 CT3 CT4 CT5 CT6 CT8 CT11 CT13
Essay	Reports and presentations of essays proposed throughout the course during the internship sessions	10	CG3 CG4 CE21 CE25 CT3 CT4

Other comments on the Evaluation

To pass the subject in in the first and second exam calls it is necessary to obtain an average grade of 5 points over 10 in the required evaluation of ongoing assessment during the year and official exam (scheduled by school). The final grade is computed using the percentages indicated. The calendar of evaluation tests is approved officially by the Board of the EEAE School and it is uploaded to the webiste: http://aero.uvigo.es/gl/docencia/exames

It will be mandatory to take the extraordinary exam of all the contents of the subject, which will be 100% of the grade, in the following cases:

- The non-execution or delivery of any of the previous points.

- Obtain a grade below 4 points out of 10 in each part of the subject exams.

The maximum length of the tests is 3 hours if there is not interruption or 5 hours if there is an intermediate pause (with 3 hours as maximum time for each part).

Students that resign officially to the ongoing assessment: the grade obtained in a corresponding test which is represents 100% of assessment. This test could have a part to be made in computer classroom and/or laboratory representing 10% of the final grade.

Sources of information

Basic Bibliography

C. Cuerno Rejado, Aeronavegabilidad y certificación de aeronaves, 1, Paraninfo, 2008,

F. de Florio, Airworthiness. An introduction to aircraft certification and operations, 3, Elsevier, 2016,

H.A. Kinnison, Aviation maintenance management, 2, McGraw-Hill, 2013,

EASA, Especificaciones de Certificación europeas de EASA, https://www.easa.europa.eu

FAA, Regulaciones Federales de Aviación de la FAA (EE.UU.), http://www.faa.gov

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Aerospace technology/O07G410V01205

Air transport and airborne systems/O07G410V01404

Aerodynamics and aeroelasticity/O07G410V01923

IDENTIFYING DATA				
Numerical calculation				
Subject	Numerical calculation			
Code	O07G410V01941			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this subject is that the students know and master different techniques and methods necessary for other subjects as well as for professional practice: the main numerical methods to solve large linear and non-linear systems, initial value and contour problems and the application of the finite element method. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• 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
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
CT3	Capability of oral and written communication in native language	• 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 How • Know be
CT6	Capabiliity for interpersonal communication	• Know How • Know be
CT8	Capabiliity for critical and self-critical reasoning	• Know How • Know be
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences

LO1: Knowledge, understanding and application of numerical methods for solving typical Aerospace Technology models and problems.	CB2 CB3 CB5 CG2 CE32 CT3 CT4 CT5 CT6 CT8 CT11
LO2: Know and use a numerical simulation software tool that uses the finite element method.	CB2 CB3 CB5 CG2 CE32 CT3 CT4 CT5 CT6 CT8 CT11

Contents

Topic	
Numerical resolution of big linear systems and non-linear systems	1. Direct methods 2. Methods iterativos. 3. Preconditioners. 4. Methods based in descent algorithms. 5. Methods for non-linear systems.
Methods for initial value and boundary value problems	1. Methods for initial value problems 2. Systems of ordinary differential equations. 3. Methods for boundary value problems.
Finite difference method for partial differential equations	1. FDM for elliptical PDE. 2. FDM for parabolic PDE. 3. FDM for hiperbolic PDE.
Finite element method	1. FEM in one dimension. 2. FEM in higher dimension. 3. FEM for vectorial problems. 4. FEM for evolutionary problems.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Lecturing	30	60	90
Problem solving	6	12	18
Autonomous problem solving	0	13.5	13.5
Computer practices	12	12	24
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 directed to take contact and gather information on the students, as well as to present the subject.
Lecturing	The professor will expose in the theoretical classes the contents of the matter that illustrate with numerous examples and applications. The students will have basic texts of reference for the follow-up of the subject.
Problem solving	Approach, analysis, resolution and debate of a problem or exercise related with the matter given, so much by part of the educational as of the students. To illustrate and complete the explanation of each lesson and to help to that the student purchase the necessary capacities.
Autonomous problem solving	The student will have to resolve similar exercises to the realised in class to purchase the necessary capacities.

Computer practices	They will use computer tools to resolve problems and exercises and apply the knowledges obtained in the classes of theory, and the student will have to resolve similar exercises to purchase the necessary capacities.

Personalized assistance

Methodologies	Description
Problem solving	The professor will attend personally the doubts and queries of the studentes. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.
Lecturing	The professor will attend personally the doubts and queries of the studentes. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.
Autonomous problem solving	The professor will attend personally the doubts and queries of the studentes. They will attend doubts in shape face-to-face, especially in the classes of problems and laboratory and in tutorials, as of form no face-to-face, by the available telematic systems for the subject.

Assessment

	Description	Qualification	Evaluated Competencess
Problem solving	Realization in an autonomous way of a collection of problems of each block of contents. LO1	30	CB2 CB3 CB5 CG2 CE32 CT3 CT4 CT5 CT6 CT8 CT11
Computer practices	Assistance and correct realisation of the practices by means of computer programs. RA1, RA2	20	CB3 CB5 CG2 CE32 CT4 CT5 CT8
Essay questions exam	Realization of a final exam in which they collect the corresponding contents to the master sessions and to the resolution of problems. LO1	50	CB2 CB3 CB5 CG2 CE32 CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

In order to pass the subject, it is necessary to complete the laboratory practices and obtain a 5 out of 10 in the final exam.

In any call it is necessary to obtain 5 points to pass the subject. The maximum duration of any exam will be 3 hours.

June-July evaluation (attendees):

The evaluation system for the second call is the same as for the first, with the grades obtained being maintained for problem

solving and/or exercises and for practices with computer programs. The exam will be marked out of 10 and will represent 50 per cent of the final qualification.

Evaluation procedure for non-attendees:

Theoretical and practical assessment: An examination to assess learning outcomes and achievement of the competencies listed in the teacher's guide. Rating: 80%

Practical evaluation of computer practices: It is essential to perform this test to pass the subject. It will consist of a practical examination on the topics covered in the computer practices during the course. Rating: 20%

Evaluation dates:

The dates of the final exams are published on the website of the EEAE http://aero.uvigo.es/gl/docencia/exames.

It expects 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/the student/to 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, will be able to realise a new examination 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

Burden, R.; Faires, J., Análisis Numérico, Iberoamericana,

Kreyszig, E., Advanced engineering mathematics, Wiley,

LeVeque, R.J., Finite difference methods for ordinary and partial differential equations, Siam,

Reddy, J. N., An introduction to the finite element method, McGraw-Hill,

Complementary Bibliography

Chapra, S., Canale, R., Métodos numéricos para ingenieros, McGraw-Hill,

Conde, L.; Winter,G., Métodos y algoritmos básicos del álgebra numérica, Reverté,

Grau, J. - Torres, R., Introducción a la mecánica de fluidos y transferencia de calor con COMSOL Multiphisics, Addlink,

Quintela,P., Matemáticas en ingeniería con Matlab, Universidade de Santiago de Compostela,

Taylor, R.L.; Nithiarasu, P.; Zienkiewicz, O.C., The finite element method, Oxford,

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201
Mathematics: Mathematical methods/O07G410V01301

IDENTIFYING DATA				
Aerospace alloys and compound materials				
Subject	Aerospace alloys and compound materials			
Code	O07G410V01942			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Pena Uris, Gloria María			
Lecturers	Guitián Saco, María Beatriz Pena Uris, Gloria María			
E-mail	gpena@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	This subject should be considered as the continuation of Materials Science and Technology, which is taught in the second year of the degree. In this course we will deepen in the study of the most used materials in the aerospace industry. We will study the light materials (metallic alloys and composite materials) used in the fuselage, wings and stabilizers, as well as the high performance alloys that are used in engines, landing gear and other elements of high responsibility. The most relevant mechanical and surface properties for its application will be presented. The study of union methods and the quality controls most commonly used will also be addressed. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How • Know be
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How • Know be
CE11	Understand the technological benefits, the techniques of optimization of the materials and the modification of their properties through treatments.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How
CE30	Appropriate knowledge applied to engineering: technological benefits, techniques of optimization of the materials used in the aerospace sector and the processes of treatments to modify their mechanical properties.	• 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
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• Know How • Know be
CT4	Capability of autonomous learning and information management	• Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know be
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• know • Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge, understanding and application of the materials employed in the aerospace sector: capacity to identify his differences.	CB3 CE11 CE19 CE30 CE33 CT4 CT8 CT11 CT13
Knowledge, understanding and application of the materials used in the aerospace sector: tools for the determination of the behaviour and properties.	CB3 CB5 CE11 CE32 CE33 CT4 CT5 CT8 CT11
Knowledge, understanding and application of the materials employed in the aerospace sector: methods of manufacture and optimización.	CB2 CB3 CB5 CE11 CE19 CE32 CE33 CT3 CT4 CT5 CT11 CT13

Contents	
Topic	
Lesson 1.- Behaviour in service of the metallic alloys	Ductile and brittle fracture. Durability. Influence of emperature in fracture processes. Embrittlement processes. Corrosión of metallic alloys: Type, Factors of influence and corrosion protection methods . Welding technologies: laser, difussion and friction stir welding.
Lesson 2.- Light alloys: Aluminium alloys. Magensium and Berilium alloys	Introduction to aluminium alloys: Processing and heat treatments. Wrought alloys (conventional and advanced). Cast alloys. Requirements for aerospace applications. Problems and optimization. Physical metallurgy, processing and properties of magnesium alloys. Effect of allouying elements. Mg alloys for aerospace application: wrought and cats alloys. Advanced alloys and processing technologies. Berilium alloys: Structure and properties of Be alloys. Main aerospace applications
Lesson 3.- Very high strength steels	High resistance stelels: quench and tempering steels. PH Steels. Stainless steels. Subject 3.- Steels of very high resistance. Maraging. Steels.
Lesson 4.- Titanium Alloys	Introduction to titanium alloys: physical metallurgy and processsing. Properties of titanium alloys.Effect of alloying elements. alfa alloys; super alfa alloys; alfa+beta alloys;quasy beta and beta alloys. Aerospace applications. Titanium sponge.
Lesson 5.- Superallloys and special alloys.	Ni and Co based Superalloys. Structural intermetallics: titanium, Ni and Fe alluminides. Shape memory Alloys. Superplastic alloys. Aerospace applications.
Lesson 6.- Metal Matrix Composites	Geenral characteristics of MMC. Types, behaviour and aplications
Lesson 7.- Polymer Matrix Composites	Fibers and Matrix: carbon fibers. Organic fibers(aramide, polyethilene), ceramic Fibers (glass, Boron, silicon carbide, ..). Metallic fibers. Thermoplastic matrix. Resins (epoxi, poyester, fenilic). Prepregs. Infusion materials. Materials for sandwich cores. Structural adhesives. Surface preparation . Properties and durability of composites.
Lesson 8.- Composite manufacturing processes	Open Mold Processes: Prepegs Processes. FRP manual procedures. Infusion Processes. Filament winding. Closed Mold processes. Mechanizing, assembly and Joining techiques.
Lesson 9.- Materials Selection	Design requirements. Materials for surfaces sustentadoras. Materials for fuselaxes.materials for fuselages, for lifting surfaces and propulsion systems. Integration of materials.

Lesson 10.- Quality Control and testing	Raw Materials and composites. Mechanical testing od metallic and composite materials. Non destructive testing: visual Inspection. Ultrasonic testing (UT) . Radiographic testing (RT). Termography. Magnetic Particle Testing (MT) and Liquid Penetrant Testing (PT) Acoustic Emission Testing (AE). Faylure Analysis.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	40	120	160
Laboratory practical	14	2.8	16.8
Problem solving	5	2.5	7.5
Case studies	4	20	24
Studies excursion	8	0	8
Objective questions exam	1.5	0	1.5
Problem and/or exercise solving	0.5	0	0.5
Presentation	0.5	3	3.5
Portfolio / dossier	0.5	1.7	2.2

*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	Subject presentation. Methodoligy description and ealuation method. Groups designation
Lecturing	Presentation by the professor of the fundamentals of the lesson. The student adquiered knowledge will be assesed by means of an exam according to the official calendar published in web http://aero.uvigo.es/gl/docencia/exame This exam will include objective and short answer questions
Laboratory practical	Activities for the practical application of the acquired knowledge. It is developed in the laboratory and with specialized equipment. They will be evaluated through a practices report
Problem solving	Resolution of problems and exercises related to the subject. Students must be able to solve problems autonomously
Case studies	The teacher makes a proposal of real cases that the student has to analyze, collect information autonomously, individually or in groups with the guidance of the teaching staff. It will be evaluated through a public presentation made to the rest of the students
Studies excursion	Visits in small group made to any of the companies in the aeronautical sector. The student must present a report of the visit made

Personalized assistance

Methodologies	Description
Lecturing	Attention that the teachers individually provide to the students to help them to solve the doubts and difficulties they can find in understanding the contents of the subject.
Case studies	Guidance given by the teacher to the student or group of students to develop the real case that was proposed to solve
Problem solving	Time in which the teacher helps the student to solve the difficulties that can be found in solving problems and practical exercises

Assessment

	Description	Qualification	Evaluated Competencess
Objective questions exam	Written individual exam in which the student will answer solme questions related to the subject presented in the classroom, demonstrating good understanding of the basic concepts, ability to organize the information and to connect concepts	50	CB2 CB3 CE32 CT4 CT8
Problem and/or exercise solving	Written test done with the previous one, in which the student must proof their ability to respond quickly, demonstrating decision-making capacity.	10	CE32 CE33 CT5 CT8

Presentation	Oral exam in which the student or a group of students presents the results of the study of a specific case that was formulated by the teachers staff. The summary of the analysis performed, the search for information, study, etc. will be presented on a poster session to their classmates. The information must be well structured, documented and clearly exposed. The defense of the work will be carried out orally, demonstrating the acquired knowledge and its communication abiliity. They must answer the questions by the faculty and the rest of the students	30	CB2 CB3 CB5 CT4 CT5 CT8 CT11 CT13
Portfolio / dossier	In the portfolio, the student must present the reports or the answer to the questions related to the laboratory practices done, as well as the study visits to the selected companies. The quality of the information, clarity of exposition and adjustment of the regulations, if applicable, will be assessed.	10	CB3 CB5 CE32 CE33 CT5 CT8 CT11 CT13

Other comments on the Evaluation

The examination writing that features of objective questions and short questions, realizaráse in the dates fixed in the calendar of proofs of evaluation approved officially by the Together of Centre of the EEAE . It finds published in the page web http://aero.uvigo.es/gl/docencia/examinations

For the evaluation corresponding to the second edition of the oficial register (June/July) those students that had regularly attended to the course, will have the possibility of choosing between keeping the qualification obtained in the Presentation and the Portfolio and take a new exam with objective questions, exercises and questions of short answer, reaching the 60% of the marks, or renounce the qualification obtained in the continuous assesment and take an exam that will evaluate all the course competencies, allowing to reach the 100% of the marks

Those students which have not attended the course, the evaluation will be done following the results of an exam to evaluate all the competencies assigned to this course.

Sources of information

Basic Bibliography

Ashby, M.; Shercliff, H.; Cebon, D., Materials. Engieneering, Science, Processing and Design, 3ª, Elsevier, B.H., 2014, Oxford, UK

Antonio Miravete, director, Materiales Compuestos, I y II, 1ª, Reverté, 2007, Barcelona

Complementary Bibliography

Prasad, N.E.; Wanhill, R.J.H., Editors, Aerospace MAterials and MAterial Tecnologies, vo:1,2, 1ª, Springer, 2017, The Netherlands

Daniel Gay, Composite Materials, 3ª, CRC Press, 2015, Florida, US

F.C, Campbell, Manufacturing technology for Aerospace Structural Materials, 1ª, Elsevier, 2006, London, UK

Augusto Javier de Santos, Análisis de Fallos en Sistemas Aeronáuticos, 1ª, Ediciones PAraninfo, 2015, Madrid

Peter J. Shull, editor, Nondestructive evaluation, 1ª, CRC Taylor & Francis, 2002, New York

Recommendations

Subjects that are recommended to be taken simultaneously

Aerodynamics and aeroelasticity/O07G410V01923
Aerospace manufacturing/O07G410V01501

Subjects that it is recommended to have taken before

Chemistry: Chemistry/O07G410V01203
Aerospace technology/O07G410V01205
Materials science and technology/O07G410V01304
Resistance of materials and resilience/O07G410V01405

IDENTIFYING DATA				
Analytic and orbital mechanics				
Subject	Analytic and orbital mechanics			
Code	O07G410V01943			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Tommasini , Daniele			
Lecturers	Tommasini , Daniele			
E-mail	daniele@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	We will study the methods of Lagrangian and Hamiltonian Analytical Mechanics, and apply them in particular to the orbital mechanics of space vehicles.			

Competencies		
Code		Typology
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How • Know be
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.	• know
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.	• know • Know How
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.	• know • Know How
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know How • Know be

Learning outcomes	
Learning outcomes	Competences

New	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Knowledge, understanding, application, analysis and synthesis of the problems astrodinámicos related with the movement of the centre of masses of a spatial vehicle; in concrete, the orbits keplerianas, the real orbits conditioned by the different perturbacións orbitales, the orbits osculatrices and the numerical methods usual in Astrodinámica	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Knowledge and understanding of the dynamics of attitude of the space vehicles	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11

Contents	
Topic	
Analytical Mechanics	Introduction to Lagrangian Mechanics
	Introduction to Hamiltonian Mechanics
	Dynamical systems: examples; linearisation; Lyapunov stability; numerical integration
Orbital Mechanics	Kepler Movement
	Perturbative Forces: modeling; numerical methods for orbit determination and orbital elements computations
	Attitude Dynamics

Planning			
	Class hours	Hours outside the classroom	Total hours
Problem solving	12	18	30
Computer practices	12	18	30
Lecturing	26	39	65
Essay questions exam	2.5	0	2.5
Practices report	0	22.5	22.5

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

Methodologies	
	Description
Problem solving	Solution of problems with the active participation of the students
Computer practices	The teacher will explain the theory
Lecturing	El docente expondrá la teoría en lecciones magistrales

Personalized assistance	
Methodologies	Description
Problem solving	The student will participate in the process of solving problems under the supervision of the teacher.
Computer practices	The student will take part in the resolution of numerical problems with the help of the teacher
Tests	Description
Practices report	The student will take part in the elaboration of the practice reports of the practices with the help of the teacher

Assessment			
	Description	Qualification	Evaluated Competencess
Problem solving	Assistance and active participation in the classes of problem solving	5	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Computer practices	Assistance and active participation in the computer practices	5	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11
Essay questions exam	Exam	70	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11

Practices report	Elaboration of a report describing the methodology and the results of the computer practices	20	CB2 CB3 CB5 CG6 CE24 CE26 CE33 CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

The students not following the continuous assessment will be evaluated only through the exam (100% in this case).

In second edition, there will be the opportunity to be evaluated only through the exam (100%) for the students who ask for it.
The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

Sources of information

Basic Bibliography

H. Schaub, J. L. Junkins, Analytical Mechanics of Space Systems, AIAA Education Series, 2009,

Howard Curtis, Orbital Mechanics for Engeneering Students 3rd Edition, 3ª, Elsevier, 2014,

Oliver Montenbruck; Eberhard Gill, Satellite Orbits: Models, Methods and Applications, Springer; HAR/CDR edition (September 2, 2011), 2011,

J. E. Prussing, B. A. Conway, Orbital Mechanics, 2ª, Oxford University Press, 2012,

A. E. Roy, Orbital Motion, Fourth Edition, 4ª, CRC Press,

William T. Thomson, Introduction to Space Dynamics, Dover Publications, 1985, New York, USA

D. A. Vallado, Fundamentals of Astrodynamics and Applications, Springer, 2007,

Complementary Bibliography

D. Tommasini, Apuntes de la asignatura,

R.R. Bate, D.D. Mueller, J.E. White, Fundamentals of Astrodynamics (Dover Books on Aeronautical Engineering) Revised ed. Edition,

P.C. Hughes, Spacecraft Attitude Dynamics, Dover Publications, 2004,

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Computer science/O07G410V01104
Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201
Mathematics: Mathematical methods/O07G410V01301
Classical mechanics/O07G410V01305
Numerical calculation/O07G410V01941

IDENTIFYING DATA				
Control and optimization				
Subject	Control and optimization			
Code	O07G410V01944			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	García Rivera, Matías			
Lecturers	García Rivera, Matías			
E-mail	mgrivera@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The aim of this subject is to present different technics of analysis and design of control systems, using classical and modern control. The technics of optimization are applied in problems of design. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• Know How
CT4	Capability of autonomous learning and information management	• Know How
CT5	Capability to solve problems and draw decisions	• 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
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences
RA01: The students have a global vision of the methods of optimisation and its applications, in particular in the modern technics of optimum control.	CB2 CB3 CB5 CE31 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Contents
Topic
Introduction to optimization
Methods of multidimensional optimization

Optimization with constraints
Discrete and sampled systems
Design of PID controllers
State-Space
Linear-quadratic controller
State Estimation
Linear-quadratic gaussian controller
Minimum variance control
Model predictive control

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	0	18
Autonomous problem solving	0	87.5	87.5
Lecturing	32	0	32
Practices report	0	10	10
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
Laboratory practical	Once developed the contents of theory and corresponding problems, students will make practices of laboratory.
Autonomous problem solving	Once developed the contents of theory and corresponding problems, students will resolve problems of autonomous form.
Lecturing	The lecturer will explain the main of the contents of the matter. Active participation of the students is required.

Personalized assistance

Methodologies	Description
Lecturing	The lecturer will advise the student with the items of theory given in classes
Laboratory practical	The lecturer will advise the student with the practices of laboratory

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	In this test concepts given in practices of laboratory will be evaluated. Learning outcomes evaluated RA01.	30	CB2 CB3 CB5 CE31 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Autonomous problem solving	The delivery of solutions to a set of exercises proposed evaluates the resolution of problems and/or exercises of autonomous form. Learning outcomes evaluated RA01.	5	CB2 CB3 CB5 CE31 CT3 CT4 CT5 CT6 CT8 CT11 CT13
Practices report	The delivery of this report of practices evaluates the assistance and active participation in the theoretical and practical classes and tutorship. Learning outcomes evaluated RA01.	5	CB2 CB3 CB5 CE31 CT3 CT4 CT5 CT6 CT8 CT11 CT13
Essay questions exam	This test evaluates theoretical concepts and the resolution of problems. Learning outcomes evaluated RA01.	60	CB2 CB3 CB5 CE31 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Other comments on the Evaluation

All references to numerical grades in this guide are about 10.
The dates of the final exams are published on the website of the EEAE in the web page http://aero.uvigo.es/gl/docencia/exames.

ASSESSMENT CRITERIA FOR ASSISTANT STUDENTS IN THE 1st EDITION OF ACTS

An assistant student is defined as the one who delivers the solutions to a series of exercises carried out autonomously and a practical report.

For a assistant students in the first edition of acts, the evaluation consists of:

- Examination of development questions. In this test theoretical concepts and problem solving related to the theory are evaluated. Represents 6 points of the final grade. In necessary to obtain a minimum of 3 points.
- Laboratory practices. In this test, concepts given in laboratory practices are evaluated. It represents 3 points of the final grade. In necessary obtain a minimum of 1.5 points.
- Delivery of the solutions to a series of proposed exercises carried out autonomously. Represents 0.5 points of the final grade. In necessary obtain a minimum of 0.25 points.
- Delivery of a practice report. Represents 0.5 points of the final grade. In necessary obtain a minimum of 0.25 points.

In the case of not reaching the required minimum in any of the parts, the subject will not be approved, and the final grade of the subject will never exceed the grade of 4.9.

EVALUATION CRITERIA FOR NON ASSISTANT STUDENTS IN THE 1st EDITION OF ACTS

For non assistant students in the first edition of the proceedings, the evaluation consists of:

- Examination of development questions. In this test theoretical concepts and problem solving related to the theory are evaluated. Represents 6.5 points of the final grade. In necessary obtain a minimum of 3.25 points.
- Evaluation of laboratory practices. In this test concepts given in laboratory practices are evaluated. It represents 3.5 points of the final grade. In necessary obtain a minimum of 1.75 points.

In the case of not reaching the required minimum in any of the parts, the subject will not be approved, and the final grade of the subject will never exceed the grade of 4.9.

ASSESSMENT CRITERIA FOR ASSISTANT AND NON ASSISTANT STUDENTS IN 2nd EDITION OF ACTS

For all students, non assistant and assistant, in the second edition of the acts the evaluation consists of:

- Examination of development questions. In this test theoretical concepts and problem solving related to the theory are evaluated. Represents 6.5 points of the final grade. In necessary obtain a minimum of 3.25 points.
- Evaluation of laboratory practices. In this test, concepts given in laboratory practices are evaluated. It represents 3.5 points of the final grade. In necessary obtain a minimum of 1.75 points.

In the case of not reaching the required minimum in any of the parts, the subject will not be approved, and the final grade of the subject will never exceed the grade of 4.9.

GRADING PROCESS

In the case of not reaching the required minimum in any of the parts, the subject will not be approved, and the final grade of the subject will never exceed the grade of 4.9.

PROHIBITION OF USE OF ANY ELECTRONIC DEVICE

Students are reminded of the prohibition of the use of any electronic device in the evaluation tests, in compliance with article 13.2.d) of the Statute of University Students, related to the duties of university students, which establishes the duty to "Refrain from using or cooperation in fraudulent procedures in the evaluation tests, in the works that are carried out or in official documents of the university. "

JUSTIFICATION OF ABSENCETo be able to justify the absence to a test is necessary a Proof of Absence or a Consultation and Hospitalization Proof (also called P10) issued by a SERGAS doctor, or a certificate issued by a medical collegiate. A proof of the doctor's appointment will not be valid.

Sources of information
Basic Bibliography
Moreno, Garrido, Balaguer, Ingeniería de Control: modelado y control de sistemas dinámicos, Ariel, 2003, Barcelona
K. OGATA, Ingeniería de control moderna, 5a, PRENTICE-HALL, 2010,
B. C. KUO, Sistemas de control automático, 7a, PRENTICE HALL, 1996, México
R. FLETCHER, Methods of Optimization, John Wiley & Sons, 2007,
Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before
Electronics and automation/O07G410V01403

IDENTIFYING DATA				
Propulsion systems				
Subject	Propulsion systems			
Code	O07G410V01945			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The matter treats on the problems of development of the systems of propulsion used in aircraft and missiles. The systems of aeronautical and space propulsion are required to make a big variety of missions, covering from the very small push during several years of performance, characteristic of some systems of propulsion employed in satellites, until the very big push acting during time very short, like the thrusters of a space launcher or of an intercontinental ballistic missile. ateria del programa English Friendly: Los/as estudiantes internacionales podrán solicitar al profesorado: a) materiales y referencias bibliográficas para el seguimiento de la materia en inglés, b) atender las tutorías en inglés, c) pruebas y evaluaciones en inglés.			

Competencies		
Code		Typology
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CE29	Appropriate knowledge applied to engineering: concepts and laws that govern the internal combustion, its application to rocket propulsion.	• know • Know How
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• know • Know be

Learning outcomes	
Learning outcomes	Competences

- To know the propulsive needs of aircraft.	CB2
- To know the thrusts and resistances related to the jet engines.	CB3
- To know and quantify in an applied way the combustion process of the jet engines and the combustion efficiency.	CB5
- To know how to perform an energy balance by differentiating and calculating the returns involved.	CG1
- To know how to solve problems related to the calculation of thermodynamic cycles and the characteristics of the jetreactors; as well as the effect of the characteristics and quality of the components.	CE29
- To know the different jet engines and know how to obtain the optimal systems from the point of view of propulsive.	CE33
- To size the components that intervene in the propulsive system.	CT3
- To use computer tools to calculate the performance of air-reactors.	CT4
- To know the effect of flight conditions: speed and altitude in the operation of the air-reactors.	CT5
- To know the environmental problems of the jet engines and their possible solutions.	CT6
- To write technical reports and make oral technical presentations related to the above.	CT8
- To solve problems derived from the field of the subject in an autonomous way and in collaboration with others.	CT11
- Knowledge and understanding of the laws that govern the movement of vehicles propelled with rocket engines; the generation of thrust and the variables on which it depends.	CT13
- Knowledge, understanding, application and analysis of the ideal model of the rocket engines with fluid dynamics propulsion and the influence of real effects.	
- Knowledge of the propellants and understanding and the combustion process of the rocket motors of solid, liquid and hybrid propellants.	
- Knowledge, understanding, application and analysis of the ionization and acceleration system of electric rocket motors.	
- Knowledge, understanding, application and analysis of the feeding and cooling systems.	
- To train to understand and simulate the physical-mathematical processes of rocket engines and to address both the problem of actions such as the synthesis or design.	

Contents

Topic
-Propellent needs of aircraft.
-Analysis of the cycle of a turbojet.
-Application of the integral equations of Fluid Mechanics to the Air-Reactors: Continuity: mass expense; Movement amount: thrusts and resistances; Energy: yields
- Engine behaviour and propeller of the air-reactors.
-Turboprops and its optimization
-Turbofans and its optimization; turbofans of mixed flow; advanced turbofans.
- Increasing push systems.
- Gas turbines.
- Component performances.
- Actuations of turbojets.
- Environmental problems derived from the operation of the air-reactors.
- General introduction: historical evolution, current status and future perspectives.
- Propulsive and thermodynamic study.
- Study of the expansion process in rocket engines with fluid dynamics propulsion.
- Solid propellant rocket engines: propellants, combustion process, performances and design fundamentals.
- Rocket engine of liquid and hybrid propellants: propellants, combustion process, power and cooling system, actions and criteria of design.
-Electric power: study of the ionization and acceleration system, propellants and power.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Laboratory practical	12	0	12
Seminars	0	2	2

Previous studies	0	79.5	79.5
Objective questions exam	2.5	0	2.5
Practices report	0	6	6
Essay	10	10	20

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

Methodologies

	Description
Lecturing	Classroom lectures
Laboratory practical	Labs with different propulsion systems Simulation labs of propulsion systems Essays assignments on propulsion systems
Seminars	Tutoring in small groups
Previous studies	Autonomous work

Personalized assistance

Methodologies	Description
Seminars	Tutoring in small groups

Assessment

	Description	Qualification	Evaluated Competencess
Objective questions exam	Partial exam of short questions and problems (20%) Final exam of short questions and problems (50%)	70	CB2 CB3 CB5 CG1 CE29 CE33 CT3 CT4 CT5 CT8 CT11 CT13
Practices report	Lab classes report	10	CB2 CB3 CB5 CG1 CE29 CE33 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Essay	Reports and presentations of essays proposed throughout the course during the lab sessions	20	CB2 CB3 CB5 CG1 CE29 CE33 CT3 CT4 CT5 CT6 CT8 CT11 CT13

Other comments on the Evaluation

To pass the subject in in the first and second exam calls it is necessary to obtain an average grade of 5 points over 10 in the required evaluation of ongoing assessment during the year and official exam (scheduled by school). The final grade is computed using the percentages indicated. The calendar of evaluation tests is approved officially by the Board of the EEAE School and it is uploaded to the webiste: http://aero.uvigo.es/gl/docencia/exames

It will be mandatory to take the extraordinary exam of all the contents of the subject, which will be 100% of the grade, in the following cases:

- The non-execution or delivery of any of the previous points.

- Obtain a grade below 4 points out of 10 in the final continuous assessment exam.

The maximum length of the tests is 3 hours if there is not interruption or 5 hours if there is an intermediate pause (with 3 hours as maximum time for each part).

Students that resign officially to the ongoing assessment: the grade obtained in a corresponding test which is represents 100% of assessment. This test could have a part to be made in computer classroom and/or laboratory representing 10% of the final grade.

Sources of information

Basic Bibliography

B. Galmés, Motores de reacción y turbinas de gas, 2, Paraninfo, 2018,

J.D. Mattingly, Elements of Propulsion: Gas Turbines and Rockets, 2, AIAA Education Series, 2016,

M. Cuesta, Motores de reacción, 9, Paraninfo, 2001,

Complementary Bibliography

Y. Cengel, Themodynamics: An engineering approach, 9 in SI, McGraw-Hill, 2019,

Recommendations

Subjects that it is recommended to have taken before

Aerospace technology/O07G410V01205
Fluid mechanics/O07G410V01402
Thermodynamics/O07G410V01303
Fluid mechanics II and CFD/O07G410V01922

IDENTIFYING DATA				
Aerospace Vehicles				
Subject	Aerospace Vehicles			
Code	O07G410V01946			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Navarro Medina, Fermín			
Lecturers	Navarro Medina, Fermín			
E-mail	fermin.navarro.medina@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject includes the study of the preliminary design of aerospace vehicles, applying the case of space vehicles. A general analysis of the subsystems is made and the analysis of mission, thermal control, power, orientation control, and structural analysis are deepened. An introduction is also made to the navigation and guidance systems of vehicles powered by rocket engines. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.	• know • Know How
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.	• know • Know How
CE27	Appropriate knowledge applied to engineering: foundations of sustainability, maintainability and operation of space systems.	• 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
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.	• know • Know How
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• Know How • Know be
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge, understanding, application and analysis of the preliminary design of aircraft	CB2 CG1 CE33 CT3 CT4

Knowledge, understanding and application of the configurations, subsystems and missions of the missiles and space vehicles.	CB3 CG1 CE27 CT6 CT8
Knowledge, understanding, application and analysis of the aerodynamic design and guided of missiles and space vehicles	CB5 CG6 CE32 CT11 CT13

Contents

Topic	
1. Introduction to the preliminary design of aerospace vehicles.	
2. Types and classification of space vehicles. General analysis of the subsystems.	2.1. Analysis of mission 2.2. Subsystem of thermal control 2.3. Subsystem of power 2.4. Subsystem of control and determination of attitude and orbit 2.5. Structural subsystem
3. Types and classification of vehicles *propulsados by engine rocket and subsystems. Subsystems of navigation, guided and control	

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	16	0	16
Laboratory practical	4	0	4
Case studies	8	0	8
Autonomous problem solving	0	97.5	97.5
Lecturing	22	0	22
Objective 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
Problem solving	Resolution of problems and/or exercises that treat punctual appearances of a subsystem, and that to his time all together tackle a more global problem of this subsystem of aerospace vehicles.
Laboratory practical	Realisation of a practice programmed related with a subsystem of space vehicle. The realisation of the practice requires the preparation of the same, the assistance and the realisation of a report by part of the students
Case studies	Approach of cases to study of subsystems of space vehicles, that involve the resolution of one or several problems, to make by the student individually and/or in group in the classroom
Autonomous problem solving	Study of the student of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university
Lecturing	Exhibition of a subject by part of the professor according to a previously established script

Personalized assistance

Tests	Description
Objective questions exam	The student studies of autonomous form, with the support of the professor if like this it requires it according to the procedures established by the university

Assessment

Description	Qualification	Evaluated Competencess

Laboratory practical	(*)Avaliación da realización do informe.	20	CB2 CB3 CB5 CG1 CG6 CE27 CE32 CE33 CT3 CT4 CT11
Case studies	(*)Avaliación da resolución dun ou varios problemas plantexados como casos de subsistemas.	20	CB2 CB3 CB5 CG1 CG6 CE27 CE32 CE33 CT3 CT4 CT6 CT8 CT11 CT13
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the subject	60	CB2 CB3 CB5 CG1 CG6 CE27 CE32 CE33 CT3 CT4 CT8 CT11 CT13

Other comments on the Evaluation

Continuous assessment: To pass the subject in the evaluation in the 1st call will be required to obtain a grade higher than 5 points out of 10 in the joint assessment of the continuous evaluation during the development of the classes and the exam on the official date.

The official exam grade must be greater than 5 points out of 10.

The final grade will be obtained according to the percentages indicated.

The punctual activities of the continuous evaluation will be carried out during the teaching hours of the subject, so regular attendance to the classes by the students is required.

The evaluation testing calendar officially approved by the EEAE Center Board is published on the web

http://aero.uvigo.es/gl/docencia/exames

The maximum duration of the exam will be 3 hours if there is no interruption or 5 hours if there is an intermediate break (3 hours maximum for each part).

Extraordinary exam

The student must submit to the extraordinary exam of all the contents of the subject, which will be 100% of the grade, if the final grade of continuous assessment is less than 5 points out of 10.

You will also have to take the extraordinary exam in the following cases :

- The non-performance or delivery of any of the points of the continuous evaluation within the established deadlines for them.

- Obtain a grade below 5 points out of 10 in the final exam of continuous evaluation.

Sources of information

Basic Bibliography

Larson W. J., Wertz J.R., Space Mission Analysis and Design, 3, Springer Netherlands, 1999, Holanda

Complementary Bibliography

Fortescue P., Stark J., Swinerd G., Spacecraft Systems Engineering, 3, Wiley, 2003, Inglaterra

Gilmore D. G., Spacecraft Thermal Control Handbook., 2, The Aerospace Press., 2002, California

Tewari A., Advanced Control of Aircraft, Spacecraft and Rockets., 1, John Wiley & Sons, 2011, 2011, Reino Unido

Recommendations

Subjects that are recommended to be taken simultaneously

Control and optimization/O07G410V01944

Subjects that it is recommended to have taken before

Analytic and orbital mechanics/O07G410V01943

IDENTIFYING DATA				
Professional internships				
Subject	Professional internships			
Code	O07G410V01981			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Martín Ortega, Elena Beatriz			
Lecturers				
E-mail				
Web	http://http://aero.uvigo.es/			
General description	By the realisation of practices in a company the student will be able to apply the knowledge and skills acquired during his/her studies, reinforcing his/her training and facilitating his/her incorporation to the labour market			

Competencies		
Code		Typology
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CE6	Adequate knowledge of the concept of a company, corporate and legal framework of a company. Organization and management of companies.	• know • Know How
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.	• know • Know How • Know be
CT2	Leadership, initiative and entrepreneurship	• Know How • Know be
CT3	Capability of oral and written communication in native lenguage	• Know How • Know be
CT4	Capability of autonomous learning and information management	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know How • Know be
CT12	Ethical and democratic commitment	• know • Know How • Know be

Learning outcomes	
Learning outcomes	Competences
Knowledge, understanding and application of the organization and planning of a company or institution of the aerospace sector.	CE6
Knowledge, understanding and application of work teams, oral and written communication skills at institutions of the aerospace sector	CB3 CB4 CB5 CT2 CT3 CT4 CT11 CT12
Knowledge, understanding, application, analysis and synthesis of diverse technical problems that appear in the companies, applying with creativity the knowledge acquired during the student studies	CB2 CE19 CT12

Contents

Topic	
General knowledge of the organisation chart and lines of activity of the company or institution.	- Visit to the installations. - To familiarize with the instrumentation, tools, programming languages and software packages used by the company - Allocation of the student to a work group. - Allocationof a work package to the student, such as present works of the company or its R&D lines. - Realization of the work entrusted. - Writing of a final report and the official documents required.

Planning

	Class hours	Hours outside the classroom	Total hours
External practices	0	150	150

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

Methodologies

	Description
External practices	Realization of the external practices in the organism/company inside the work group and task assigned

Personalized assistance

Assessment

	Description	Qualification	Evaluated Competencess
External practices	Evaluation by the company supervisor during the development of the practices (official report D5) Evaluation of the memory of practices delivered by the student when finalising. Evaluation of the report of the academic supervisor designated by the centre. The students will keep in touch not only with the company supervisor, but also with the academic supervisor. When concluding the practices, the students will have to deliver to his academic supervisor a final memory and also the official document D6-Report of the student. The evaluation will take into account the follow-up made by the academic tutor and the reports delivered by the student.	100	CB2 CB3 CB4 CB5 CE6 CE19 CT2 CT3 CT4 CT11 CT12

Other comments on the Evaluation

This course follows the specific regulation of the School in this matter:

http://aero.uvigo.es/images/docs/escuela/normativa/Practicas_EEAE.pdf

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Final Year Dissertation				
Subject	Final Year Dissertation			
Code	O07G410V01991			
Study programme	(*)Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The Final Degree Project (TFG) is an original and personal work that each student will carry out independently under the tutorship of the academic staff and will allow them to demonstrate, in an integrated manner, the acquisition of the knowledge and the competences associated with the degree. 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
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study	• know • Know How
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues	• know • Know How
CB4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience	• know • Know How
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.	• know • Know How
CT2	Leadership, initiative and entrepreneurship	• know • Know be
CT3	Capability of oral and written communication in native lenguage	• know • Know How
CT4	Capability of autonomous learning and information management	• know • Know How
CT5	Capability to solve problems and draw decisions	• know • Know How
CT6	Capabiliity for interpersonal communication	• know • Know How
CT7	Capability to adapt to new situations with creativity and innovation	• know • Know How
CT8	Capabiliity for critical and self-critical reasoning	• know • Know How
CT9	Capability to work in interdisciplinary teams	• know • Know How
CT10	Capability to negotiate and deal with and act in situations of conflict	• know • Know How
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies	• know • Know be
CT12	Ethical and democratic commitment	• know • Know be
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources	• know • Know be

Learning outcomes	
Learning outcomes	Competences

Realization of a personal and original work, both in the title and in the contents, carried out autonomously under teacher tutoring, which must allow the acquisition of the training contents and the competences associated with the title to be shown in an integrated manner.	CB2 CB3 CB4 CB5 CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT9 CT10 CT11 CT12 CT13

Contents

Topic	
Classical projects of aerospace engineering	For example, the design and even the manufacture of a prototype, the engineering of a production facility or the implementation of a system in any aerospace field.
Technical studies, organisational and economic.	Reports related to equipment, materials, systems, services, etc., in the fields of aerospace engineering, dealing with one or more aspects related to design, planning, production, management, exploitation and any other engineering field. They must compare technical alternatives to economic evaluations and allow the discussion and evaluation of the results when necessary.
Theoretical works-experimental	Theoretical-experimental nature works, which contribute to the technique in different fields of engineering, including, when appropriate, the evaluation and economic discussion and evaluation of the results.

Planning

	Class hours	Hours outside the classroom	Total hours
Previous studies	0	90	90
Project based learning	0	120	120
Mentored work	20	0	20
Project	0	50	50
Presentation	1	19	20

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

Methodologies

	Description
Previous studies	Autonomous work aimed at the acquisition of theoretical knowledge.
Project based learning	Oriented to practical application.
Mentored work	Dedication of the student at the facilities of the School of Aeronautical Engineering and Space: - Student assistance to the school laboratories for the development of the project. - Tutorials with the tutor and / or co-tutor. Meetings with the student dedicated to the application of methods and techniques, review of documents, presentation rehearsal, etc.

Personalized assistance

Methodologies	Description
Mentored work	Tutorials with tutor and/or co-tutor

Assessment

Description	Qualification	Evaluated Competencess

Project	Tutor evaluation of the project: 25% Academic tribunal evaluation: 50% - Evaluation of the scope of the project. The scientific-technical difficulty of the work will be evaluated (25%) - Evaluation of the documentation. The quality of the TFG memory will be evaluated (25%)	75	CB2 CB3 CB4 CB5 CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT9 CT10 CT11 CT12 CT13
Presentation	Academic tribunal evaluation: 25% - Evaluation of the presentation. Aspects such as clarity in the presentation, use of time, quality of the material used and answering the questions of the tribunal members are evaluated.	25	CB2 CB3 CB4 CB5 CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT9 CT10 CT11 CT12 CT13

Other comments on the Evaluation

The TFG is an original exercise that is carried out individually, is presented in front an academic tribunal. It must be a project in the field of specific technologies of Aerospace engineering, with a professional nature, in which students synthesize and integrate the competences acquired during their studies. The performance and evaluation of the TFG is regulated by the Regulation of the Final Degree Project of the School of Aeronautical Engineering and Space approved by the School Board in their meeting of December 19th, 2018.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

Ethical commitment: student must present a suitable ethical behaviour. If a no ethical behaviour (cheating, plagiarism, or others) is detected, a fail (0,0) will be the global mark for the student.

Requirements: Enrollment in TFG course must be done only if the students enroll in all the remaining subjects necessary to get their degree..

Important information: The TFG only can be presented and evaluated if there are objective evidence that the students passed all the other necessary subjects to obtain their degree, according to the Univsersity of Vigo TFG Regulation, approved on 5th of June of 2016 and modified on 13 of November of 2018.

Plagiarism will be prosecuted using plagiarism software tool.