(*)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).

Grado en Ingeniería Aeroespacial

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
O07G410V01101	Mathematics: Calculus I	1st	6
O07G410V01102	Mathematics: Linear algebra	1st	6
O07G410V01103	Physics: Physics I	1st	6
O07G410V01104	Computer science	1st	6
O07G410V01105	Graphic expression: Graphic expression	1st	6
O07G410V01201	Mathematics: Calculus II	2nd	6
O07G410V01202	Physics: Physics II	2nd	6
O07G410V01203	Chemistry: Chemistry	2nd	6
O07G410V01204	Business: business technology and management	2nd	6
O07G410V01205	Aerospace technology	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
O07G410V01301	Mathematics: Mathematical methods	1st	6
O07G410V01302	Electrical engineering	1st	6
O07G410V01303	Thermodynamics	1st	6
O07G410V01304	Materials science and technology	1st	6
O07G410V01305	Classical mechanics	1st	6
O07G410V01401	Mathematics: Statistics	2nd	6
O07G410V01402	Fluid mechanics	2nd	6
O07G410V01403	Electronics and automation	2nd	6
O07G410V01404	Air transport and airborne systems	2nd	6
O07G410V01405	Resistance of materials and resilience	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
O07G410V01501	Aerospace manufacturing	1st	6

Year 4th

Code	Name	Quadmester	Total Cr.
O07G410V01701	Proyect direction and management	1st	6
O07G410V01901	Navigational systems	2nd	6
O07G410V01903	Materials for the aerospace industry	2nd	6
O07G410V01904	Systems in real time	2nd	6
O07G410V01905	Meteorology	2nd	6
O07G410V01910	Information management systems	2nd	6
O07G410V01913	Forming technology of aerospace materials	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
O07G410V01921	Solid mechanics and aerospace structures	1st	9
O07G410V01922	Fluid mechanics II and CFD	1st	9
O07G410V01923	Aerodynamics and aeroelasticity	2nd	9

Year 4th

Code	Name	Quadmester	Total Cr.
O07G410V01924	Mechanics of flight	1st	6

Year 3rd

Code	Name	Quadmester	Total Cr.

O07G410V01925	Systems engineering and aerospace communications	2nd	6
O07G410V01931	Air-jet and aeronautic alternative engines	1st	6
O07G410V01932	Mechanical design, FEM and vibrations	2nd	9
O07G410V01933	Space vehicles	2nd	6

Year 4th			
Code	Name	Quadmester	Total Cr.
O07G410V01934	Fixed-wing and rotary wing aircrafts	1st	9
O07G410V01935	Maintenance and certification of aerospace vehicles	1st	9

Year 3rd			
Code	Name	Quadmester	Total Cr.
O07G410V01941	Numerical calculation	1st	6
O07G410V01942	Aerospace alloys and compound materials	2nd	9
O07G410V01943	Analytic and orbital mechanics	2nd	6

Year 4th			
Code	Name	Quadmester	Total Cr.
O07G410V01944	Control and optimization	1st	6
O07G410V01945	Propulsion systems	1st	6
O07G410V01946	Aerospace Vehicles	1st	6
O07G410V01981	Professional internships	2nd	6
O07G410V01991	Final Year Dissertation	2nd	12

IDENTIFYING DATA				
Mathematics: Calculus I				
Subject	Mathematics: Calculus I			
Code	O07G410V01101			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Area Carracedo, Iván Carlos			
Lecturers	Area Carracedo, Iván Carlos			
E-mail	area@uvigo.gal			
Web	http://area.webs.uvigo.es			
General description	The aim of this course is for students to acquire the techniques of differential calculus in both one and several variables, as well as integral calculus in one variable, which are essential for other courses in the degree program and for professional practice. International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C1	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.
C32	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.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning

Expected results from this subject	Training and Learning Results			
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	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8

Contents	
Topic	
Sequences and series.	Sequences and series. Convergence. Numeric series of positive terms. Convergence criteria. Power series.
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
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
Practices through ICT	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 the course content during the theoretical classes. Students will have basic reference texts to help them follow the material.
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 engage with and gather information about the students, as well as to introduce the subject.
Autonomous problem solving	The students will have to solve exercises independently to check the acquisition of the skills.
Practices through ICT	The professor will solve problems and exercises, similar to those analyzed in lectures, using computer tools. The students will have to solve similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	Description
Lecturing	The professor will personally address students' questions. These will be resolved in person, especially during problem-solving and laboratory sessions, as well as during tutorials, and through the remote options available for the course.
Problem solving	The professor will personally address students' questions. These will be resolve in person, especially during problem-solving and laboratory sessions, as well as during tutorials, and through the remote options available for the course.

Assessment

	Description	Qualification	Training and Learning Results			
Autonomous problem solving	A written exam will be conducted at the end of the first part of the course (sequences and series) to assess the independent solution of exercises and/or problems,which will account for 20% of the final mark. Another written test will be conducted at the end of the second part of the course (calculus in one variable), also to evaluate for 30% of the final mark.	50	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8
Practices through ICT	The practicals represent 10 % of the final mark and will be evaluated beginning in the second session.	10		B2	C1 C32	D1 D3 D4 D5 D8
Essay questions exam	A final exam on the contents of all the course will be given.	40	A1	B2	C1 C32	D1 D3 D4 D5 D8

Other comments on the Evaluation

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

The final grade for students with continuous assessment is calculated as follows:

- 20% with a written test at the end of the first part of the subject related to sequences and series
- 30% with a written test at the end of the part related to calculation of a variable
- 10% as a result of practices from the second to the sixth
- 40% with a final exam on the contents of the entire subject

To pass the final exam, students must obtain at least 30% of the maximum mark in each section of the course. If a student fails to reach this 30% threshold in any section but achieves a weighted total score of 5 points or higher, the recorded grade will be 4.9 points (failed)).

The evaluation system for the second exam call is the same as for the first, with grades for problem-solving, exercises, class attendance, and participation being carried over.

Students who do no attend classes or the regular exam call can take a comprehensive exam 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:

Students are expected to maintain appropriate ethical behavior. If unethical behavior is detected (e.g., cheating, plagiarism, unauthorized use of electronic devices), the student will not fulfill the requirements to pass the course.

In such cases, the overall grade for the current academic year will be marked as a failure (0.0). If necessary, an additional exam may be conducted to verify the acquisition of skills and knowledge by the student(s) involved.The use of mobile devices or laptops during exercises and practical sessions is prohibited, as per Real Decreto 1791/2010 of December 30, which approves the Statute of University Students. Article 13.2.d) specifically requires students to:

"Refrain from using or cooperating in fraudulent activities during evaluation tests, in the preparation of assignments, or in official university documents."

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

Other comments

The tutorial schedule will be published at https://area.webs.uvigo.es/titorias/ Students can book tutorials using this link.

IDENTIFYING DATA				
Matemáticas: Álxebra lineal				
Subject	Matemáticas: Álxebra lineal			
Code	O07G410V01102			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Galego			
Department	Matemáticas			
Coordinator	Pájaro Diéguez, Manuel			
Lecturers	Pájaro Diéguez, Manuel			
E-mail	mapajaro@uvigo.gal			
Web	http://aero.uvigo.es/gl/			
General description	Esta materia enmárcase dentro da materia Matemáticas e impártese no primeiro semestre do primeiro curso. As outras materias de Matemáticas son: Cálculo I, no primeiro semestre do primeiro curso e Cálculo II no segundo semestre do primeiro curso. Nela adquírense competencias da álxebra lineal, sendo unha parte delas fundamentais para as outras materias de Matemáticas. A materia ten carácter de formación básica. Proporciona a base matemática a distintas disciplicinas no ámbito da enxeñaría aeronáutica como son o cálculo e fabricación de vehículos e a simulación numérica.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
B2	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.
C1	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.
C32	Coñecemento adecuado e aplicado á Enxeñaría de: Os métodos de cálculo e de desenvolvemento dos materiais e sistemas da defensa; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación numérica dos procesos físico-matemáticos máis significativos; as técnicas de inspección, de control de calidade e de detección de fallos; os métodos e técnicas de reparación máis adecuados.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia				
Expected results from this subject	Training and Learning Results			
Coñecemento e comprensión dos principais conceptos, técnicas e métodos numéricos da Álxebra Lineal. Capacidade para aplicalos a outras ramas das Matemáticas e das Ciencias da Enxeñaría.	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8

Contidos	
Topic	
BLOQUE I	1. Números complexos. 2. Sistemas de ecuacións lineais.
BLOQUE II	3. Espazos vectoriais 4. Aplicacións lineais e matrices.

BLOQUE III	5. Espazos vectoriais euclideanos. 6. Diagonalización. Aplicacións ortogonais
BLOQUE IV	7. Métodos numéricos: resolución de sistemas de ecuacións lineais. Cálculo de autovalores

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	1	2
Lección maxistral	18	37	55
Resolución de problemas	27	30	57
Resolución de problemas de forma autónoma	4	17	21
Exame de preguntas de desenvolvemento	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.

Metodoloxía docente

	Description
Actividades introdutorias	Actividades encamiñadas a tomar contacto e reunir información sobre o estudantado, así como a presentar a materia.
Lección maxistral	Exposición dos contidos da materia por parte do docente que se ilustran con numerosos exemplos e aplicacións.
Resolución de problemas	Formulación, análise, resolución e debate dun problema ou exercicio relacionado coa materia impartida para ilustrar e completar a explicación de cada lección.
Resolución de problemas de forma autónoma	Proporanse exercicios e problemas que os estudantes deben resolver en grupo utilizando aprendizaxe colaborativa como metodoloxía integrada.

Atención personalizada

Methodologies	**Description**
Actividades introdutorias	Atención e resolución de dúbidas ao alumnado en relación ás diferentes actividades da materia.
Lección maxistral	Atención e resolución de dúbidas ao alumnado en relación ás diferentes actividades da materia.
Resolución de problemas	Atención e resolución de dúbidas ao alumnado en relación ás diferentes actividades da materia.
Resolución de problemas de forma autónoma	Atención e resolución de dúbidas ao alumnado en relación ás diferentes actividades da materia.
Tests	**Description**
Exame de preguntas de desenvolvemento	Antes da realización da proba ou exame, atención e resolución de dúbidas ao alumnado en relación ás diferentes actividades da materia.

Avaliación

	Description	Qualification	Training and Learning Results			
Resolución de problemas de forma autónoma	Dúas probas parciais sobre os contidos correspondentes aos dous primeiros bloques (sesións maxistrais e resolución de problemas)	60	A1	B2	C1 C32	D3 D4 D5 D8
Exame de preguntas de desenvolvemento	Exame final no que se recollerán os contidos correspondentes ás sesións maxistrais e a resolución de problemas de toda a materia. Duración: 2.5 horas	40	A1	B2	C1 C32	D3 D4 D5 D8

Other comments on the Evaluation

CRITERIOS DE AVALIACIÓN PARA A PRIMEIRA OPORTUNIDADE

Seguindo o método da avaliación continua:

Se un estudante non se presenta a proba parcial ou o exame final, asignaráselle unha cualificación de 0 puntos nela.

P1: Nota da proba parcial 1;

P2: Nota da proba parcial 2;
F: Nota do exame final.

No caso de acadar como mínimo un 4.5 no exame final, a cualificación en actas será:

máx(F, 0.3*P1 + 0.3*P2 + 0.4*F)

No caso de non acadar como mínimo un 4.5 no exame final, a cualificación en actas será:

mín(4.5, máx(F, 0.3*P1 + 0.3*P2 + 0.4*F))

Seguindo o método da avaliación global:

A calificación será a puntuación no exame final.

O/a estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. Nótese que debido á natureza das fórmulas de avaliación, non é necesario que o alumno tome ningunha decisión.

CRITERIOS DE AVALIACIÓN PARA A SEGUNDA OPORTUNIDADE DE A CONVOCATORIA EXTRAORDINARIA (FIN DE CARREIRA)

Farase unha proba con tódolos contidos da materia e a puntuación acadada será a cualificación final.

DATAS DE AVALIACIÓN

A proba parcial realizarase dentro do horario lectivo.

As datas do exame final e da proba correspondente a segunda edición de actas serán as fixadas no calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE que se atopa publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

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Bibliografía. Fontes de información
Basic Bibliography
González, R., **Álxebra linear**, 1ª ed, Universidade de Vigo, 2021
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
Merino, L.; Santos, E., **Álgebra Lineal con métodos elementales**, 1ª ed, Paraninfo, 2006
Complementary Bibliography
Baker, R.; Kuttler, K., **Linear algebra with applications**, 1st ed, World Scientific, 2014
Burgos, Juan de, **Álgebra lineal y geometría cartesiana**, 3ª ed, S.A. Mc Graw Hill, 2006
Castellet, M. ; Llerena, I., **Álgebra Lineal y Geometría**, 1ª ed, Reverté, 1991
Lipschutz, S., **Álgebra Lineal**, 2ª ed, S.A. Mc Graw Hill, 1992

Recomendacións

IDENTIFYING DATA				
Physics: Physics I				
Subject	Physics: Physics I			
Code	O07G410V01103			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Lorenzo González, María de las Nieves			
Lecturers	Cabrera Crespo, Alejandro Jacobo Des Villanueva, Marisela Fernández Nóvoa, Diego Lorenzo González, María de las Nieves			
E-mail	nlorenzo@uvigo.es			
Web	http://aero.uvigo.es/			
General description	This course will provide the fundamental principles of mechanics, specifically classical mechanics. Mechanics is the branch of the physics that focuses on the study of the behaviour of bodies, whether at rest or in motion. In Physics I, the fundamentals of classical mechanics will be studied, building a foundation that will be expanded upon in next year's Classical Mechanics course. Physics I covers both the basics of kinematics and dynamics. Kinematics focuses on the study of the movement of the bodies, without considering the causes of that movement. In other words, it answers the question: How does a body move? Dynamics, on the other hand, examines the causes of the movement of bodies and its evolution, addressing the question: Why is this body moving? This course is essential, as it establishes the foundational principles for understanding the behaviour of the bodies, whether at rest or in motion. 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.			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

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	3	6.5	9.5
Research based methodologies	1	4	5
Programmed instruction	0	5	5
Laboratory practical	12	0	12
Essay questions exam	2.5	0	2.5
Report of practices, practicum and external practices	0	6	6
Self-assessment	0	12	12
Problem and/or exercise solving	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 theoretical content of the course will be presented and it will be applied to solving concrete problems
Autonomous problem solving	The student should solve exercises following some instructions.
Research based methodologies	Improves information processing in specific domains by using scientific research activities.
Programmed instruction	It consists of presenting the material divided into several smaller teaching units, with questions at the end of each unit to reinforce the knowledge acquired. These activities can be completed either in person or virtually.
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 laboratory tasks, students will receive personal guidance to help them achieve the objectives
Research based methodologies	Tutoring sessions will be scheduled to address any questions the students may have.

Assessment

	Description	Qualification	Training and Learning Results
Research based methodologies	Students will present the results of their research. It may account for up to 15% of the final mark.	15	
Laboratory practical	In order to pass the course, students will carry out laboratory tasks, which will be included in the continuous assessment mark. The mark for the practicals may account for up to 15% of the total mark for the subject. The practicals will be assessed by: i) continuous assessment during the practical and presentation of results, and ii) a multiple-choice exam. The completion and passing of the practicals is a prerequisite for passing the course. Duly justified absences will be compensated with alternative tasks.	15	
Essay questions exam	There will be an exam that includes questions and exercises. The maximum marks of this part will be 40% of the final total mark. However, a minimum of 5 over 10 has to be reached on the exam to pass the course.	40	
Self-assessment	At the end of each subject, students may answer a multiple-choice questionnaire and/or solve problems that may account for up to 10% of the final mark.	10	

Problem and/or exercise solving	In the middle of the course there will be a short evaluation test consisting of solving problems and/or answering questions. This test may account for up to 20% of the final mark. The mark for the essay questions exam may be 4 out of 10 to be averaged with the rest of the marks if the student passes the problem solving and/or exercise-based test with at least 50% of the mark.	20

Other comments on the Evaluation

The second call assessment system is the same as the first call assessment system, maintaining the grades obtained for research-based methodologies, problem solving and/or exercises and practicals.

Assessment dates:

The exam calendar officially approved by the Xunta de Centro is published on the website:

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

The laboratory practicals must have been completed in order to be able to sit the second call exam.

Students who are unable to attend classes must inform the teacher. In this case, the exam will count for 85% of the mark and the practicals for 15%.

In summary:

The breakdown of the total mark for the subject is as follows:

- Exam: up to 40%. It is necessary to get a 5 out of 10 in the exam to pass the subject.

- Self-assessment test: up to 10%.

- Laboratory practicals: up to 15%. It is compulsory to pass the practicals in order to pass the subject.

- Research work: up to 15%.

-Evaluation test of problems and/or exercises: up to 20%. The breakdown of the total mark for students who do not opt for continuous assessment is as follows:

- Examination/exams: up to 85%, a minimum of 5 out of 10 must be obtained to pass the course.

- Laboratory practicals: up to 15%. It is compulsory to pass the practicals in order to pass the subject.

VERY IMPORTANT:

In order to add up all the percentages, the student must get at least 5 out of 10 on the exam mark. If the student scores below 5 on the exam, the mark recorded will be the exam mark. The duration of the final exam will be approximately 2.5 hours.

In the event that the student obtains 50% or more of the mark on the problem solving and/or exercise-based test, he/she will only need to score a minimum of 4 out of 10 on the final exam to have all the percentages count towards their grade. If the student scores below a 4 on the final exam, the mark recorded will be the final exam mark.

Students who fail the first call exam and do not attend class will have the option of taking the second call exam covering the entire content of the subject, provided that they have completed the laboratory practicals.

In special cases where students cannot attend the practicals or take part in the continuous assessment for justified and previously notified reasons, 100% of the mark will be based on a final exam that assesses all the competences of the course.

Final exam: Students who choose to take the final exam will be assessed only on the basis of their final exam (which will be worth 100% of the mark). If they do not attend the exam, or do not pass it, they will be assessed in the same way as the rest of the students.

If plagiarism is detected on any of the tests, the final mark will be SUSPENSO (or "FAIL") (0) and the incident will be reported to the school's administrators for appropriate follow-up actions.

Exam-only assessment: The student has the right to opt for the exam-only assessment according to the procedures and the deadlines established by the centre for each call.

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

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

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

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

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

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

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

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				
Informática: Informática				
Subject	Informática: Informática			
Code	O07G410V01104			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Castelán			
Department	Informática			
Coordinator	Pérez Pérez, Martín			
Lecturers	Pérez Pérez, Martín			
E-mail	martiperez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Nesta materia establécense os contidos básicos de informática e de introdución á programación necesarios para os graduados e graduadas en Enxeñaría Aeroespacial.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
C3	Coñecementos básicos sobre o uso e programación dos computadores, sistemas operativos, bases de datos e programas informáticos con aplicación en enxeñaría.
D1	Capacidade de análise, organización e planificación
D2	Liderado, iniciativa e espírito emprendedor
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D9	Capacidade de traballo en equipo de carácter interdisciplinar

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecemento, comprensión e aplicación das técnicas de programación básicas e do seu uso na resolución dos modelos numéricos da Enxeñaría.	A1	C3	D4 D5 D9
Coñecemento comprensión e aplicación sobre a metodoloxía da programación (datos e operacións básicas, programación modular, operacións de entrada-saída, etc.).	A1	C3	D1 D2 D4 D5 D6 D8 D9
Coñecemento básico sobre os sistemas operativos e as linguaxes de programación, orientados fundamentalmente á formulación e implementación de métodos numéricos específicos en enxeñaría.	A1	C3	D1 D3 D4 D5 D9

Contidos	
Topic	
Introdución á informática	Hardware: compoñentes e conceptos básicos Conceptos básicos de software Sistemas operativos IAs xenerativas e de apoio á programación Seguridade informática Redes de computadoras / big data

Conceptos de programación básicos	Tipos de linguaxes de programación: baixo e alto nivel Variables Funcions Control de fluxo Entrada/saída
Conceptos de programación avanzados	Tipos de datos avanzados Excepcións Manexo de ficheiros
Programación orientada á resolución de modelos numéricos usados na enxeñaría	Librarías matemáticas Representación gráfica

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	0.5	0	0.5
Lección maxistral	20.5	46	66.5
Prácticas con apoio das TIC	22	40	62
Prácticas de laboratorio	6	8.5	14.5
Resolución de problemas de forma autónoma	1	3	4
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: obxectivos, competencias que deberá adquirir o estudantado, contidos, sistema de avaliación. Formación de grupos de traballo.
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas e/ou directrices dos traballos, exercicios ou proxectos a desenvolver polo estudantado.
Prácticas con apoio das TIC	Resolución de exercicios formulados nas sesións prácticas, a partir dos coñecemenos traballados.
Prácticas de laboratorio	Desenvolvemento de programas e documentos en que os e as estudantes reflicten as características dos traballos realizados. Os e as estudantes deben describir as tarefas e procedementos desenvolvidos, mostrar os resultados ou observacións realizados, así como a análise e o procesamiento de datos.
Resolución de problemas de forma autónoma	Actividade na que os/as estudantes analizan e resolven problemas e/ou exercicios relacionados coa materia de forma independente.

Atención personalizada

Methodologies	Description
Prácticas con apoio das TIC	Os e as estudantes terán un seguimento continuo e unha atención personalizada a través das clases de resolución de exercicios e control dos traballos realizados. Tamén poderán asistir, se o desexan, a titorías personalizadas.
Resolución de problemas de forma autónoma	Os e as estudantes poderán asistir, si deséxano, a titorías personalizadas.

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas con apoio das TIC	Asistencia e participación activa	5	A1	C3	D3 D4 D5 D8
Prácticas de laboratorio	Probas de avaliación individuais en computador ao longo do curso, consistentes na resolución de pequenos problemas de programación. Os e as estudantes deben dar resposta á actividade formulada, aplicando os coñecementos prácticos da materia de forma autónoma. -PUNTUACIÓN MÍNIMA: media de 4 (sobre 10)	65	A1	C3	D1 D2 D3 D4 D5 D8
Resolución de problemas de forma autónoma	Desenvolvemento de programas e documentos en que os e as estudantes reflicten os contidos aprendidos	5	A1	C3	D1 D4 D5 D6 D9

Exame de preguntas obxectivas	Proba/s de avaliación que valoran os coñecementos adquiridos por parte do alumno, aplicando de forma autónoma os contidos teóricos da materia. A proba levará a cabo na data establecida no calendario oficial de exames. -PUNTUACIÓN MÍNIMA: media de 4 (sobre 10)	25	A1	C3	D3 D4 D5 D8

Other comments on the Evaluation

SISTEMA DE AVALIACIÓN CONTINUA

O/A estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. O sistema de avaliación por defecto para todo o alumnado é o de avaliación continua (artigo 19 do regulamento sobre a avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do alumnado, aprobado no claustro o 18 de abril de 2023).

SISTEMA DE AVALIACIÓN GLOBAL

Posto que o sistema de avaliación por defecto é o de AVALIACIÓN CONTINUA, considérase que todo o alumnado matriculado opta por dito sistema. No caso de querer ser avaliados mediante o sistema de AVALIACIÓN GLOBAL, "*Unha vez superado o prazo dun mes desde o comezo do cuadrimestre, habilitarase un prazo de 5 días hábiles para que o alumnado matriculado na materia manifeste, formalmente, a súa intención de acollerse ao sistema de AVALIACIÓN GLOBAL*".

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CRITERIOS DE AVALIACIÓN PARA 1ª OPORTUNIDADE

- **Sistema de avaliación continua:** Todos/as os/as estudantes que opten pola modalidade de avaliación continua serán avaliados de maneira continua mediante a realización de probas e actividades, desenvolvidas ao longo do cuadrimestre, aplicando os criterios xerais de avaliación descritos no apartado anterior.¡

- **Sistema de avaliación global:** Todos/as os/as estudantes que opten pola modalidade global serán avaliados **cun exame final único** (100% da nota) que englobará todo o visto ao longo do cuadrimestre, aplicando os seguintes criterios xerais de avaliación. Do mesmo xeito que no caso anterior, o sistema de avaliación global consta de dúas partes: (i) exame de preguntas obxectivas e (ii) Proba práctica de laboratorio:

  - **Avaliación teórica:**
    - **Descrición:** Exame de preguntas obxectivas sobre conceptos teóricos e resolución de exercicios.
    - **Metodoloxía(s) aplicada(s):** Exame de preguntas obxectivas.
    - **% Cualificación:** 35%
    - **Mínimo:** Para superar esta parte da materia deberase obter unha cualificación igual ou superior a 4 puntos (sobre 10).**Proba de programación**
  - **Avaliación práctica:**
    - **Descrición:** Proba individual en ordenador de resolución de pequenos problemas de programación.
    - **Metodoloxía(s) aplicada(s):** Prácticas de laboratorio.
    - **% Cualificación:** 65%
    - **% Mínimo:** Para superar esta parte da materia deberase obter unha cualificación igual ou superior a 4 puntos (sobre 10).

CRITERIOS DE AVALIACIÓN PARA 2ª OPORTUNIDADE E FIN DE CARREIRA:

Na segunda oportunidade (xullo) e ao final da chamada -Career, o sistema de avaliación global utilizarase anteriormente anteriormente. Competencias avaliadas: o mesmo que no sistema de avaliación continua. Competencias avaliadas: as mesmas que no sistema de avaliación continua. **Resultados de aprendizaxe avaliados**: os mesmos que no sistema de avaliación continua.

CRITERIOS XERAIS DE AVALIACIÓN:

Independentemente do sistema de avaliación e da convocatoria, para superar a materia o/a estudante debe obter, como nota final, unha cualificación igual ou superior a 5. Se nos bloques de *Prácticas de laboratorio e/ou Exame de preguntas obxectivas* o/a estudante obtén unha nota inferior a 4, aínda que a nota media sexa igual ou superior a 5, a materia estará suspensa e a cualificación final que figurará na acta será Suspenso (4).

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PROCESO DE CUALIFICACIÓN DE ACTAS

Independentemente do sistema de avaliación e da convocatoria, no caso de non superar algunha parte da avaliación, pero a puntuación global fose superior a 4 (sobre 10), a cualificación en acta será 4.

DATAS DE AVALIACIÓN

As probas parciais realizaranse dentro do horario lectivo. As datas do exame final e da proba correspondente á segunda edición de actas serán as fixadas no calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE e que se atopa publicado na páxina web http://aero.uvigo.es/gl/docencia/exames/

USO DE DISPOSITIVOS MÓBILES

Lémbrase a todo o alumnado a prohibición do uso de dispositivos móbiles en exercicios e prácticas, en cumprimento do artigo 13.2.d) do Estatuto do Estudante Universitario, relativo aos deberes do estudantado universitario, que establece o deber de "*Absterse do uso ou cooperación en procedementos fraudulentos nas probas de avaliación, nos traballos que se realicen ou en documentos oficiais da universidade*".

COMPROMISO ÉTICO

Espérase que o/a estudante presente un comportamento ético axeitado e lémbrase ao alumnado que o fraude académico, como copiar en probas de avaliación ou plagiar traballos, pode constituír unha infracción grave ou moi grave, segundo o establecido na **Lei 3/2022, do 24 de febreiro, de convivencia universitaria (artigo 11.g)**. No caso de detección de plaxio ou copia en calquera das probas, a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

CONSULTA/SOLICITUDE DE TITORÍAS

As titorías poden consultarse a través da páxina persoal do profesorado, accesible en https://www.uvigo.gal/es/node/236361

Bibliografía. Fontes de información

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

Juan Weber, **Fundamentos de informatica**, 9789875721735, Jorge Sarmiento Editor - Universitas, 2021

Guardati Buemo, Silvia and Cairó Battistutti, Osvaldo}, **Aprende a programar en Python : de cero al infinito**, 978-84-267-3489-1, Primera edición, Marcombo, 2023

Complementary Bibliography

Recomendacións

Other comments

RECOMENDACIÓNS

Recoméndase que o *estudiantado conte con coñecementos básicos de informática, tales como a organización de arquivos e cartafoles, o uso de ficheiros comprimidos (por exemplo en formato .zip), a comprensión das extensións de arquivo, así como certa familiaridade coa navegación web e o uso de plataformas dixitais como Moovi. Non se esixe experiencia previa en programación; con todo, valorarase unha actitude proactiva cara á aprendizaxe no uso do computador e a xestión do seu sistema de arquivos.

Directrices para o estudo:
- Asistir ás clases.
- Realizar os exercicios nas prácticas.
- Revisar a bibliografía e recursos web.

Propostas de mellora e recuperación:
- Os estudantes que teñan problemas para seguir o ritmo de aprendizaxe da materia deben asistir ás *tutorías cos profesores e ampliar o tempo dedicado á aprendizaxe independente e autónoma.

IDENTIFYING DATA				
Expresión gráfica: Expresión gráfica				
Subject	Expresión gráfica: Expresión gráfica			
Code	O07G410V01105			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	Riol Cañedo, José Carlos			
Lecturers	Riol Cañedo, José Carlos			
E-mail	jriol@uvigo.es			
Web	http://aero.uvigo.es/gl/			
General description	O obxectivo principal da materia é formar ao alumnado para xestionar e aproveitar os sistemas e técnicas de representación máis empregados na actualidade pola industria aeroespacial, que se basean na xeometría, xa sexa: métrica, proxectiva, analítica, descritiva ou computacional. O coñecemento dos métodos de xeración de formas, as súas propiedades e a súa xestión en diversos contextos da enxeñaría, tanto no plano como no espazo 3D, require un adecuado desenvolvemento das capacidades de análise, síntese e visualización (abstracción e idealización), así como a utilización. da linguaxe gráfica. A normalización, necesaria para a definición exhaustiva de formas, compoñentes, obxectos, mecanismos ou instalacións, nos respectivos proxectos, require o coñecemento das normas básicas relativas a formatos, liñas, modos de representación, dimensións, símbolos e todo tipo de especificacións xeométricas do produto (GPS). A formación nunha aplicación gráfica actual que facilite a creación de modelos 3D, os seus respectivos planos, a montaxe de compoñentes, a simulación e o movemento, a interactividade entre diferentes arquivos ou o acotado paramétrico, completa este enfoque.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
C5	Capacidade de visión espacial e coñecemento das técnicas de representación gráfica, tanto por métodos tradicionais de xeometría métrica e xeometría descritiva, como mediante as aplicacións de deseño asistido por computador.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Desenvolvemento da capacidade de análise e interpretación gráfica de enunciados, propiedades e situacións de diversa índole prantexados en contextos de enxenaría.	A1	C5	D1 D3 D6
Desenvolvemento da capacidade de abstracción e idealización.	A1	C5	D1 D4 D8
Coñecemento dos principios xerais sobre deseño xeométrico.		C5	D1 D3 D6 D8
Coñecemento das principais ferramentas e técnicas de representación.	A1	C5	D4 D6 D8

Contidos	
Topic	
TEORÍA	.

1- Introdución á Normalización	1.1-Gráficos na Enxeñaría para a visualización de datos, a comunicación e a definición formal dos obxectos. 1.2-Linguaxe gráfica e Normalización. Organismos para a normalización. 1.4-Normas básicas para a elaboración de planos: formatos, escalas, liñas, vistas e anotacións. 1.5-Principios xerais de representación. Elección de vistas e cortes. Normativa. 1.6-Sistemas europeo e americano. Adaptación aos sistemas CAD.
2- Curvas planas e as súas aplicacións.	2.1-Cónicas: propiedades, trazados e aplicacións. 2.2-Estudo proxectivo das cónicas 2.3-Curvas de rodadura. Aplicacións. 2.4-Outras curvas: espirais, envolventes, evolutas, etc. Aplicacións. 2.5-Aproximacións poligonais a unha curva plana. 2.6-Curvas alabeadas. Triedro intrínseco. A hélice.
3- Fundamentos e Técnicas dos Sistemas de Representación.	3.1-Fundamentos proxectivos dos sistemas de representación. Tipos de proxección. 3.2-Paso dun sistema a outro. 3.3-Pares, ternas e cuaternas. Invariantes proxectivos. 3.4-Formas proxectivas. Categorías. 3.5-Homoloxía e afinidade. 3.6-Sistema diédrico: operacións básicas, medida de ángulos e distancias. Intersecccións. 3.7-Sistema axonométrico directo e indirecto. Tipos de axonometría. Proxección oblicua. 3.8-Sistema de planos acoutados. Aplicacións: topografía, cubertas, trazado de viais.
4- Visualización e representación de formas corpóreas.	4.1-Representación de corpos nos diversos sistemas de representación. 4.2-Operacións específicas para a obtención de vistas nunha determinada dirección, partes vistas e ocultas, intersecccións. 4.3- Determinación de verdadeiras magnitudes mediante xiros, abatementos e cambios de plano.
5- Superficies regradas e as súas aplicacións	5.1-Clasificación xeral das superficies. 5.2-Superficies regradas: desenvolvibles e alabeadas. Aplicacións. 5.3-Superficies curvas. A esfera. Geodesia. 5.4-As cuádricas. Aplicacións. 5.5-Intersecccións entre superficies. 5.6-Superficies poliédricas. Tipos, características, elementos de simetría e representación. 5.7-Agrupamento de poliedros e compartimentación do espazo.
6- Elementos e Formas de Acotación	6.1-Acotación. Elementos básicos. 6.2-Principios xerais de acotación. Sistemas de referencia. 6.3-Elementos roscados. 6.4-Tipos de acotación. Criterios. 6.5-Normativa básica. 6.6-Acotación funcional. 6.7-Tolerancias dimensionais. Axustes. Casos. 6.8-Tolerancias xeométricas. Especificacións nos debuxos. 6.9-Acabados superficiais. Especificacións.
7- Representación de Elementos Normalizados e Conxuntos	7.1-Representación e utilización de compoñentes normalizados nos mecanismos. Elementos de unión. Elementos de transmisión. Outros. 7.2-Debuxos de conxunto. Características. 7.3-Especificacións nos debuxos de conxunto. 7.4-Lista de pezas. 7.5-O ensamblado 3D no ordenador, establecemento de relacións entre compoñentes, animacións, estudos de movemento e simulacións.
8- Fundamentos de simboloxía e representacións esquemáticas para Enxeñaría	8.1-Simboloxía en Enxeñaría. Iconicidade. 8.2-Representacións esquemáticas. 8.3-Aplicacións: mecánica, electricidade e electrónica. 8.4-Normas.
PRÁCTICAS.	.

1- DESEÑO ASISTIDO POR ORDENADOR	Presentación do programa por parte do profesor o primeiro día. Descrición das principais características e posibilidades da ferramenta. Exercicios orientados ao adestramento e a familiarización cos comandos e funcións fundamentais. Procederase a xeración directa de modelos 3D da que derivarán as vistas e cortes necesarios para a súa definición normalizada en 2D. Finalmente efectúase o ensamblado de compoñentes coas restricciones apropiadas que permiten a animación dos mesmos e a simulación. Ao longo do curso utilizaranse os distintos tipos de cotas (condutoras, conducidas, dependentes de unha ecuación matemática ou dun parámetro, vinculadas, etc.).
2- PRÁCTICAS ORDINARIAS	Comezarase cun repaso das construccións xeométricas básicas, realizado á man, que necesariamente require de traballo na casa. Cada parte teórica será complementada con exercicios a realizar durante as horas de práctica, nas sucesivas semanas, que o discente debe completar na casa. En paralelo realizarase o adestramento na aplicación e iranse resolvendo exercicios no computador de modo que se capacite ao estudantado para elaborar o traballo final no ordenador.
3- TRABALLO PRÁCTICO (TrP)	Proponse a realización dun traballo práctico (TrP) a realizar durante todo o curso, en grupos de 1-3 alumnos, a modo de pequeno proxecto relacionado con mecanismos habituais do entorno da aeronáutica (conxunto, subconxunto ou grupo de compoñentes que desempeñen algunha función relacionada coa temática aeroespacial), no que se refire á súa definición gráfica. A complexidade pode variar segundo a elección de cada grupo.

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	0	2	2
Lección maxistral	26	50	76
Prácticas con apoio das TIC	24	36	60
Seminario	0	2	2
Resolución de problemas de forma autónoma	0	7.5	7.5
Exame de preguntas de desenvolvemento	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 na data establecida polo Centro. Aspectos a repasar e refrescar sobre conceptos fundamentais e construccións xeométricas básicas, a realizar na casa a primeira semana do curso.
Lección maxistral	Sesión maxistral activa na que cada unidade temática será presentada polo profesor e complementada cos comentarios dos estudantes, baseados na bibliografía xeral que se facilita e noutra específica que se poda engadir para cada tema particular.
Prácticas con apoio das TIC	As prácticas presenciais complemetaranse con exercicios a resolver na casa, de maneira individual ou colectiva, á man e/ou con ordenador, orientados á aplicación da teoría e a acadar destreza tanto na utilización das ferramententas tradicionais como automatizadas o que implica a utilización das TICs. Habilitarase un espazo a tal fin en moovi.
Seminario	Para orientación e seguimento do traballo práctico, formación de grupos e resolución de dúbidas.
Resolución de problemas de forma autónoma	Exercicios curtos, prantexados semanalmente, a resolver polo alumno na casa; así como un traballo a desenvolver durante o curso para entregar ó remate, consistente na creación dos compoñentes e ensamblado dos mesmos para configurar o mecanismo.

Atención personalizada

Methodologies	Description
Seminario	Selección do traballo a desenvolver, coa guía do profesor
Actividades introdutorias	Repaso de cuestións básicas, incluso con algunha clase presencial extra, voluntaria, para os que non cursaran as materias previas no bacharelato.

Avaliación

Description	Qualification	Training and Learning Results

Lección maxistral	Exame ordinario con preguntas de desenvolvemento de teoría e exercicios prácticos, sobre dos contidos tratados nas distintas sesións, a realizar: 1º parcial en torno á semana 7ª (30%). Examen final na data establecida polo centro, que comprende: 2º parcial (30%), máis a recuperación ou mellora do 1º parcial.	60	A1	C5	D1 D3 D4 D6 D8
Prácticas con apoio das TIC	Avaliación das prácticas realizadas semanalmente, que se completan na casa. Publicaranse informes periódicos coas calificacións obtidas.	30	A1	C5	D1 D4 D6
Resolución de problemas de forma autónoma	Avaliación dun traballo realizado durante o curso, consistente no deseño de compoñentes, ensamblado dos mesmos e simulación do mecanismo.	10		C5	D1 D3 D4 D8

Other comments on the Evaluation

A avaliación continua incluirá todo o traballo desenvolvido de modo presencial ou non presencial, daquelas actividades individuais e grupais programadas (neste último caso a cualificación será individual para cada compoñente do grupo). A materia supérase por avaliación continua ao alcanzar o 50% da puntuación máxima da proba en cada unha das 3 partes nas que se divide.

A mediados do curso (aproximadamente na semana 7ª) realizarase un exame parcial (30% da nota total). A cualificación desta primeira parte será a obtida nese exame parcial ou ben na súa recuperación no exame final. O exame final, na data fixada polo centro, constará de dúas partes: a recuperación do primeiro parcial máis o exame do segundo parcial. A cualificación do segundo parcial será a obtida no exame final desta parte (30% da nota total). O 40% restante da nota total, segundo a metodoloxía anteriormente esposta, obterase polas prácticas e traballos realizados durante o curso nas porcentaxes indicadas.

O/A estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. Nesta avaliación global, no caso de non seguir o proceso de avaliación continua, o alumno só poderá presentarse ao exame final da materia, podendo, nese caso, completar o devandito exame cunha parte correspondente ás prácticas que se ponderaría con 30% da nota e con outra parte correspondente á resolución de problemas de forma autónoma que se ponderaría co 10%. A súa cualificación será a obtida no devandito exame. e para aprobar a materia, o alumnado debe obter polo menos o 50 % da puntuación máxima en cada unha das tres partes do exame. Se as exercicios prácticos (30 %) e a resolución independente de problemas (10 %) foron aprobados durante a o curso, non será necesario completar estas seccións no exame global e a cualificación da materia será a mesma que a obtida no exame sen elas.

Os resultados obtidos nas probas intermedias non teñen impacto máis aló da avaliación continua na primeira oportunidade.

O alumnado que non supere a materia en primeira oportunidade deberá realizar unha proba final de segunda oportunidade, que abarcará todos os contidos da materia, tanto teóricos como prácticos, e que poderá incluír probasde resposta curta, probas de resposta longa, resolución de problemas e desenvolvemento de presupostos prácticos. Este sistema de probas será o mesmo para a convocatoria de Fin de Ccarreira.

Datas avaliación: Segundo o calendario de exames aprobado oficialmente pola Xunta da Escola, que se publica na súa páxina web: http://aero.uvigo.es/gl/docencia/exames. A parte práctica, de ser o caso, podería requerir algún tipo de prova ó marxe de tales datas.

Compromiso ético: espérase que o alumno mostre uncomportamento ético adecuado.

No caso de detectarse copia nalgunha das probas (probas curtas, exames parciais ou exame final), a cualificación será de SUSPENSO (0) eo feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

AENOR, **Normas varias, actualizadas**, Segundo cada norma, Bilioteca/Norweb,

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

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

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

Complementary Bibliography

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

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

Prieto Alberca, M., **Geometría Aplicada al Diseño**, ADI, 2010
Company, P.; Vergara, M; Mondragón, S., **Dibujo Indiustrial**, Universitat Jaume I, 2007

Recomendacións

Subjects that continue the syllabus

Dirección e xestión de proxectos/O07G410V01701

Other comments

A conveniencia de:
1) ter cursado as materias de "Debuxo Técnico" no bacharelato de Ciencias e Tecnolóxico como parte introductoria, para facilitar o proceso de aprendizaxe;
2) ter utilizado programas CAD en cursos previos.

IDENTIFYING DATA				
Mathematics: Calculus II				
Subject	Mathematics: Calculus II			
Code	O07G410V01201			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@dma.uvigo.es			
Web	http://aero.uvigo.es/gl/			
General description	The objective of this course is for students understand ans master the basic techniques of the integral calculus, vector calculus, ordinary differential equations and their applications, which are essential both for other courses in the degree 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.			

Training and Learning Results	
Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C1	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.
C32	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.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning

Expected results from this subject	Training and Learning Results			
Knowledge and understanding of the main concepts and techniques of the integral calculus in several variables.	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8
Knowledge and understanding of the models that adopt the form of ordinary differential equations and the main elementary techniques of integration.	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8

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.	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8

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	0	1
Lecturing	28	56	84
Problem solving	15	15	30
Autonomous problem solving	0	14.5	14.5
Practices through ICT	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 aimed at engaging with and gatjering information about the students, as well as introducing the course content.
Lecturing	The professor will present the course content in theoretical classes, illustrating it with numerous examples and applications. Students will have basic reference texts to support their unsdertanding of the material.
Problem solving	Approach, analysis, solution and discussion of a problem or exercise related to the material, both by the instructor and the students. This aims to illustrate and complete each lesson, helping students to acquire the necessary skills.
Autonomous problem solving	The student will have to resolve similar exercises to the realised in class to purchase the necessary capacities.
Practices through ICT	The professor will use computer tools to resolve problems and exercises and apply the knowledge obtained in theory classes. Students will also have to do similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	Description
Lecturing	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course.
Problem solving	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course.
Autonomous problem solving	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course.

Assessment

Description	Qualification	Training and Learning Results

Autonomous problem solving	There will be a written test for each part of the course to evaluate the independent resolution of exercises and/or problems. Each test will have a weight of 25%. RA1, RA2, RA3	50	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8
Practices through ICT	Attendance and correct completion of the practical exercises using computer programmes. RA3	10			C1	D1 D4 D5 D8
Essay questions exam	Completion of a final exam covering the content of the lectures and the problem-solving sessions. RA1, RA2	40	A1	B2	C1 C32	D1 D3 D4 D5 D8

Other comments on the Evaluation

The preferred mode of assessment is continuous assessment. The student has the right to opt for the overall assessment (100% of the grade on the official date) according to the procedure and deadline established by the centre for each exam call.

In any exam call it is necessary to obtain 5 points to pass the course. 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. If a grade lower than 2 points is obtained in any part, the final grade on the transcript will be the sum of both scores, capped at a maximum of 4.8 points. (*)

Second exam call evaluation:

An exam vill asses the learning outcomes and competences outlined in the teaching guide. The exam will account for 100% of the final grade. In a student scores al least 3 points in one part (and less than 2 points in the other part), he may choose to retake only the failed part or the entire exam. The criterion indicated in (*) will also apply.
Exam-only assesment procedure (any call):

The end-of-degree exam call follows the comprehensive assessment procedure.

An examination will be conducted to assess the learning outcomes and the competences indicated in the instructor's guide. This exam will constitute 100% of the mark of this exam call. The criterion indicated in (*) will also apply.

Evaluation dates:

The evaluation schedule officially approved by the EEAE is published on the website http://aero.uvigo.es/es/docencia/examenes/

Students are expected to demonstrate appropriate ethical behaviour. If unethical behaviour is detected (such as copying, plagiarism, unauthorized use of electronic devices, etc), the student will deemed not to meet the necessary requirements to pass the course. In such cases, the final grade of the academic year will be recorded as a failing grade (0.0).

Please, be reminded of the prohibition on using mobile devices or laptops during exercises and practical sessions. According to Royal Decree 1791/2010, of December 30, which approves the Statute of the University Student, Article 13.2.d) specifies the duties of university students, including the obligation to:

"*Abstain of the utilisation or cooperation in fraudulent activities during evaluations, assignments, or official university documents*".

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

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Salgueiro Piñeiro, José Ramón			
Lecturers	Michinel Álvarez, Humberto Javier Salgueiro Piñeiro, José Ramón			
E-mail	jrs@uvigo.es			
Web	http://aero.uvigo.es			
General description	The matter of Physics II is fundamentally oriented to provide the training and basic competences on the basic electromagnetism, including its main theoretical practical aspects. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C2	Understanding and mastery of the basic concepts about the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems related to engineering.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning

Expected results from this subject	Training and Learning Results			
Knowledge and understanding of the basic principles of Physics and their application to the analysis and to the resolution of problems in engineering	A1	B2	C2	D1 D3 D4 D5 D6 D8
Knowledge, understanding and application of the principles of electromagnetism, including telectrostatics, magnetostatics and Maxwell's equations.	A1		C2	D5 D8
Knowledge, understanding and application of the general laws of classical Thermodynamics, introducing the concept of thermodynamic equilibrium and the most important thermodynamic magnitudes.	A1		C2	D5 D8

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

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

Planning

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

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

Methodologies

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

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

Assessment					
	Description	Qualification	Training and Learning Results		
Essay questions exam	Two problem-solving and question-solving tests distributed throughout the semester, each of which will account 35% of the total score for the subject. These tests will be recoverable. Additionally, there will be other small proofs and tasks after activities in the classroom, susceptible to be evaluated up to a 10% of the total qualification. These profs will not be recoverable.	80	A1	C2	D1 D3 D8
Report of practices, practicum and external practices	Attendance to the laboratory sessions and realization of laboratory tasks (10%). Subsequent preparation of a report on laboratory activities and realization of a project (10%). Laboratory activities are not recoverable. Laboratory report and project are recoverable.	20	B2	C2	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

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

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

Recovery of continuous assessment tests:

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

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

Exam-only assessment:

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

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

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

Feynman, R. P., **Física (vol. I)**, Addison Wesley, 1998
Feynman, R. P., **Física, vol. II**, Adidison Wesley, 1998
Serway, R. A., **Electricidad y magnetismo**, 4ª, McGraw-Hill, 1996
Cheng, D.K., **Fundamentos de electromagnetismo para ingeniería**, Addison Wesley Iberoamericana, 1988
Edminister, J.A., **Circuitos Eléctricos**, McGraw-Hill, 1997
Edminister, J.A., **Electromagnetismo**, McGraw-Hill, 1993
Serrano, V, **Electricidad y Magnetismo: Estrategias para la resolución de problemas y aplicaciones**, Prentice Hall, 2001
Sabah, N.H., **Electric circuits and signals**, CRC Press, 2008
Callen, H. B., **Termodinámica: introducción a las teorías físicas de la termostática del equilibrio y de la termodinámica**, AC, 1981
Varios, **http://wikipedia.org**,

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus II/O07G410V01201

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Mathematics: Calculus I/O07G410V01101

IDENTIFYING DATA

Chemistry: Chemistry

Subject	Chemistry: Chemistry			
Code	O07G410V01203			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly #ItalianoAmichevole #PortuguêsAmigável Spanish Galician			
Department				
Coordinator	Rivas Siota, Sandra			
Lecturers	Ferreira Santos, Pedro Rivas Siota, Sandra Rubira Pérez, Alexandre			
E-mail	sandrarivas@uvigo.es			
Web	http://aero.uvigo.es			
General description	This subject is intended to form students in a diversity of theoretical and applied aspects (including those related with the structure of the matter, thermochemistry, chemical equilibria, kinetics and industrial chemistry), which are necessary for a more complete training of the students of the degree in aerospace engineering .			

Training and Learning Results

Code	
A1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
C4	Capability to understand and apply the principles of basic and general chemistry, organic and inorganic chemistry and their application in engineering.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D8	Capabiliity for critical and self-critical reasoning
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Knowledge, understanding and application of the chemical principles related with his application in the engineering	A1	C4	D1 D3 D4 D5 D8 D13
Knowledge of the chemical properties more stood out in relation with the behaviour of the materials	A1	C4	D1 D3 D4 D5 D8 D13

Contents

Topic	
1. GENERAL ASPECTS and PREVIOUS CONCEPTS	1.1 Magnitudes, dimensions, units and unit systems 1.2 Change of units 1.3 Dimensional/dimensionless equations 1.4 Concentration expression modes 1.5 Stoichiometry and related concepts

2. The ATOM	2.1 Structure and constituent particles 2.2 Atomic Theory: atomic orbitals 2.3 Atomic orbitals and energy: atomic structures 2.4 Characteristics of atoms 2.5 Isotopes
3. COVALENT BONDING	3.1 Nature of the chemical bonding 3.2 Lewis theory: molecular structures 3.3 Molecular Geometry 3.4 Valence Bond Theory 3.4 Theory of orbital molecular
4. IONIC BONDING	4.1 Ions 4.2 ionic Solids: nature 4.3 Network energy 4.4 Properties of the ionic solids
5. METALLIC BONDING	5.1 Metallic Solids 5.2 Metallic Bonding
6. INTERMOLECULAR INTERACTIONS	6.1 Nature of the intermolecular interactions 6.2 Types of intermolecular interactions 6.3 Molecular Interactions and states of aggregation
7. GASES And SOLUTIONS	7.1 Characteristics of gases 7.2 Ideal Gases 7.3 Real Gases 7.4 Dissolutions 7.5 Liquids and liquid solutions 7.6 Coligative properties of solutions
8. TERMOCHEMISTRY	8.1 Heat, internal energy and enthalpy 8.2 Enthalpy challenges associated with chemical reactions 8.3 Entropy and free energy: criteria of spontaneous evolution of chemical reactions
9. CHEMICAL EQUILIBRIUM	9.1 Concept of equilibria 9.2 Constant of equilibra 9.3 Types of equilibria 9.4 Reaction rate 9.5 Le Chatelier's principle 9.6 Thermodynamic relationships
10. ACID-BASE EQUILIBRIUM	10.1 Definitions of acid and base. 10.2 Autoionization of the water and ionic product. pH and pOH 10.3 Certainty of acids and bases. Calculation of pH 10.4 Poliprotic acids 10.5 Hydrolysis 10.6 Buffer solutions
11. SOLUBILITY EQUILIBRIUM	11.1 Solubility of salts 11.2 Sparingly soluble Salts 11.3 Factors affecting solubility 11.4 Fractional precipitation
12. REDOX EQUILIBRIUM	12.1 basic Concepts of oxidation and reduction 12.2 Redox reactions: coupling in acidic or basic mediums 12.3 Redox titrations
13. ELECTROCHEMISTRY	13.1 Electrochemical Cells: basic concepts 13.2 Standard electrode and cell potentials 13.3 Thermodynamics of the electrochemical reactions 13.4 Nernst equation. Applications 13.5 Batteries and cells 13.6 industrial electrolysis processes 13.7 Corrosion
14. KINETICS	14.1 Basic Concepts 14.2 Factors that modify the rate of a reaction 14.3 Determination of the kinetic equation of a reaction

15. INTRODUCTION to ORGANIC CHEMISTRY	15.1 Structure of organic compounds 15.2 Alkanes, alkenes, alkynes and halogenated derivatives of the hydrocarbons 15.3 Aromatic Hydrocarbons 15.4 Alcohols, phenols and ethers 15.5 Aldehydes and ketones 15.6 Carboxylic Acids, esters and derivatives 15.7 Amines and amides 15.8 Nitriles and nitro derivatives 15.9 Reactions of organic compounds 15.10 Organic chemistry in the aerospace industry

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	50	78
Seminars	10	47.5	57.5
Laboratory practical	12	0	12
Essay questions exam	1	0	1
Essay questions exam	1.5	0	1.5

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

Methodologies

	Description
Lecturing	They will expose the theoretical and practical foundations of each one of the subjects of the matter, with the support of the bibliography and audiovisual materials and will stimulate the participation of the *estudiantado. It contemplates the realisation of tests of theory in schedule of classes.
Seminars	
Laboratory practical	Of parallel way to the sessions *magistrales, in the seminars will tackle exercises related with the matter. The/the student will have previously of bulletins that include all the exercises of the matter. It contemplates the possibility that the *estudiantado resolve of autonomous way a part of the same.

Personalized assistance

Methodologies	Description
Laboratory practical	It will stimulate the participation in class, so that the students can propose questions for additional discussion or resolve exercises of application in front of his own mates.
Lecturing	It will procure involve to the students in the explanations, directing them questions and allowing themarouse doubts, that *eventualmente will be able to result in subjects of discussion that the own studentswill be able to expose in class after the suitable preparation.
Seminars	

Assessment

	Description	Qualification	Training and Learning Results		
Lecturing	The learning results and the competencies related to the theoretical contents of the subject will be evaluated by means of various tests.	15	A1	C4	D1 D4 D5 D8
Seminars	The learning results and the competencies related to the application of the concepts of the subject will be evaluated through the resolution of various exercises/problems.	15	A1	C4	D1 D3 D4 D5 D8 D13
Laboratory practical	The completion of the lab practices is a sine qua non requirement to pass the subject. On the official date for the exam, there will be a multiple-choice test or short answer questions on the contents of the lab practices, which will score up to 5%. A value of 5% is also given to the attitude and work during the laboratory stay.	10	A1	C4	D1 D3 D4 D5 D8

Essay questions exam	Throughout the course a date will be set for an exam of theory and exercises of part A (Topics 1 to 8) of the course. Each of the two parts (theory and exercises) will be worth 15%.	30	A1	C4	D1 D3 D4 D5 D8 D13
Essay questions exam	On the official dates, there will be an exam of theory and exercises of part B (Topics 9 to 15), to evaluate the learning outcomes related to the contents of the subject. Each of these parts will have a value of 15%.	30	A1	C4	D1 D3 D4 D5 D8 D13

Other comments on the Evaluation

1. Evaluation systems for 1st and 2nd opportunity

Two evaluation systems are proposed: **continuous** and **global.**

1.1. **Continuous evaluation:** in general, this will be the evaluation modality.

1.1.1. **First opportunity.**The final grade will be determined according to the following assessments:

I. **Laboratory practices**: up to 10% of the total grade of the subject.The satisfactory completion of the laboratory practicals is a prerequisite for passing the course.The qualification of the practices will depend on the experimental work carried out in the laboratory and on the grade obtained in a test-type questionnaire that will be carried out on the day of the official exams. Students who did the practicals in previous courses will keep the grade obtained at the time. The practical grade (in base 10) will be denoted hereinafter as CPrac.

II. **Continuous evaluation tests**: up to 30% of the total grade of the subject. Throughout the course, there will be 2 continuous evaluation tests: one related to part A (Topics 1-8 of the subject) and 1 related to part B (Topics 9-15 of the subject). Each test will have a duration of 1 hour and will consist of 1 questionnaire of multiple-choice questions and several problems. All these deliveries will be made in the usual classroom and during class time. The grades of the continuous evaluation tests (in base 10 each one of them) will be denoted hereinafter as CEvC1 and CEvC2, respectively.

III. **Partial exam (part A)**: up to 30% of the total grade of the subject (15% corresponds to theory and 15% to problems).At the end of part A of the subject (Topics 1-8) there will be a partial exam, which is optional and will have separate parts of theory and problems. The grades for each part, in base 10 each, are denoted hereinafter as CTA and CPA, respectively. Those students who simultaneously achieve CTA ≥ 3.5 and CPA ≥ 3.5 (compensable fail) may, if they wish, validate their grades for the final exam (i.e., they will not be required to take the subject of part A in the final exam). Students who did not take the partial exam, students who do not meet the conditions for validating their grade for the final exam, and any other student who wishes to do so, may take a new exam on the day of the final exam of the course (see below) at for the entire subject of part A (theory and problems).
IV. **Final exam (parts A and B)**: up to 30% of the total grade of the subject in each part (15% corresponds to theory of each part and 15% to problems of each part).Students who did not take the partial exam, those who do not meet the necessary conditions to compensate the subject of part A, and those who meeting these conditions wish to re-examine the corresponding contents , may take the final exam of part A (theory and problems), to be held on the day officially. The grades obtained in this exam in theory and problems (in base 10) will replace the values of CTA and CPA that, if applicable, were obtained in the partial exam. Note that in this case the CTA and CPA values obtained in the partial exam will not influence the final grade.The exam of part B will be held on the date officially fixed for the final exam of the subject, and will have separate parts of theory and problems. The grades for each part, in base 10 each, are denoted at below as CTB and CPB, respectively.**Calculation of the grade of the first opportunityThe provisional grade of the subject (CProv) will be the result of applying the following equation:**
CProv= 0.1·CPrac + 0.15·CEvC1 + 0.15·CEvC2+ 0.15·CTA+ 0.15·CTB+0.15·CPA+ 0.15·CPB

The grade (CActa) may or may not coincide with CProv. Thus:
a) When each and every one of the following conditions are met:CProv ≥ 5 and CTA ≥ 3.5 and CPA ≥ 3.5 and CTB ≥ 3.5 and CPB ≥ 3.5. The subject will be passed, with CActa = Cprov.b) Students with Cprov < 5 will have CActa = Cprov.c) Those students who achieve CProv ≥ 5 but fail to comply with any of the other conditions indicated in section a) will be graded with CActa = 4.9.
1.1.2. Second opportunity.
- The grades CPrac, CEvC1 and CEvC2 obtained in the first opportunity will be kept. The test will consist of exams of theory and problems of parts A and B as well as practical (for those students who did not do it previously or who, having done it, wish to take it again). If repeated, the grade obtained in this case will replace to the previous grade.
- Compensations. Those students who have obtained in the first opportunity CTA ≥ 3.5 and CPA ≥ 3.5 will be

able, if they wish, to validate the subject of part A for the second opportunity, and not to take the exam of the corresponding subjects. Those students who have obtained in the first opportunity CTB ≥ 3.5 and CPB ≥ 3.5 may, if they wish, validate the subject of part B for the second opportunity, and not examine the corresponding subjects. The grades obtained in the second opportunity [(CTA and CPA) and/or (CTB and CTB)] will replace, in their case, those obtained in the first opportunity.
- Both parts (A and B) will be treated as indivisible blocks, i.e., when a student does not meet any requirement of minimum grades in theory or in problems of a certain part, he/she will have to take the exam of the whole part (theory and problems).The value of CProv will be calculated as indicated above, after replacing the grades of theory and problems of the parts A and/or B by the values obtained in the second opportunity. The subject will be passed when:CProv ≥ 5 and CTA ≥ 3.5 and CPA ≥ 3.5 and CTB ≥ 3.5 and CPB ≥ 3.5The criteria for the assignment of CActa will be the same as described for the first opportunity.1.2. Global evaluationStudents will have the right to opt for the global evaluation following the procedure and the deadline established by the center for each call. In all cases, the final grade of the subject will be calculated by means of a test that will include a practice exam (grade in base 10, CPrac') and theory exams and problems of parts A and B (grades in base 10, CTA, CPA, CTB, CPB, respectively).
The provisional grade (Cprov') will be calculated as follows:
Cprov'= 0.225·CTA+ 0.225·CTB+0.225·CPA+ 0.225·CPB+ 0.10·Cprac'

The grade on record (CActa') may or may not coincide with CProv'.a) CActa' will match CProv' if CProv'≥ 5 and CTA ≥ 3.5 and CPA ≥ 3.5 and CTB ≥ 3.5 and CPB ≥ 3.5.b) CActa' shall coincide with CProv' if CProv'< 5.c) If the above conditions are not met, CActa' will take the value 4.9.
2. End of Career Call
For the End of Career Call, the evaluation will be done through an exam of theory, problems and practices, and the grade will be calculated in an identical way as described in the global evaluation. 3. Exam datesThe dates of the exams will be published on the bulletin board and/or on the Center's website. The exams will be held in person at, unless the U. de Vigo decides otherwise.

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

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

Recommendations

Subjects that are recommended to be taken simultaneously

Physics: Physics II/O07G410V01202
Mathematics: Calculus II/O07G410V01201

Subjects that it is recommended to have taken before

Physics: Physics I/O07G410V01103
Mathematics: Calculus I/O07G410V01101

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	Choose	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego			
Department	Organización de empresas e márketing			
Coordinator	Carlos Villamarín, Pablo de			
Lecturers	Carlos Villamarín, Pablo de			
E-mail	pdecarlo@uvigo.es			
Web	http://aero.uvigo.es			
General description	A materia ten como obxectivo principal proporcionar ao estudantado unha formación básica en materia económica e empresarial, que lle axude a coñecer e interpretar a realidade socioeconómica na que desenvolverá a súa actividade profesional no sector aeroespacial. Para iso, presentaranse e desenvolveranse diversos conceptos fundamentais da análise microeconómica e macroeconómica, da economía da empresa e, en particular, da xestión da innovación por parte das organizacións empresariais.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
B2	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.
B5	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.
B8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.
C6	Coñecemento adecuado do concepto de empresa, marco institucional e xurídico da empresa. Organización e xestión de empresas.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D9	Capacidade de traballo en equipo de carácter interdisciplinar
D10	Capacidade de tratar e actuar en situacións de conflitos e negociación
D12	Compromiso ético e democrático

Resultados previstos na materia				
Expected results from this subject	Training and Learning Results			
- Coñecemento, comprensión, análise e síntese da microeconomía e macroeconomía	A1	B5	C6	D1 D3 D4 D5 D6 D8 D9 D10 D12

- Coñecemento dos aspectos básicos dos tipos de empresas e a súa xestión e organización	A1	B2 B8	C6	D1 D3 D4 D5 D6 D8 D9 D10 D12

Contidos
Topic
Bloque I: Microeconomía
Bloque II: Macroeconomía
Bloque III: Economía da empresa
Bloque IV: Xestión da innovación

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	1	2
Traballo tutelado	9	4	13
Flipped Learning	31	81.5	112.5
Resolución de problemas	9	1	10
Exame de preguntas obxectivas	1	5	6
Presentación	1.5	5	6.5

*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 estudantado, así como a presentar a materia.
Traballo tutelado	O estudantado, de maneira individual ou en grupo, elabora un documento sobre a temática da materia ou prepara seminarios, investigacións, memorias, ensaios, resumos de lecturas, conferencias, etc. É obrigatorio asistir ás clases prácticas para realizar o traballo.
Flipped Learning	Algunhas actividades de aprendizaxe realizaranse fora da aula, e coa presenza do docente se facilitará e potenciará outros procesos de adquisición e practica de coñecementos.
Resolución de problemas	Actividade na que se formulan problema e/ou exercicios relacionados coa materia. O estudantado debe desenvolver as solucións adecuadas ou correctas mediante a exercitación de rutinas, a aplicación de fórmulas ou algoritmos, a aplicación de procedementos de transformación da información dispoñible e a interpretación dos resultados. É obrigatorio asistir ás clases prácticas para realizar esta proba.

Atención personalizada

Methodologies	**Description**
Traballo tutelado	Atención das consultas do estudantado relacionadas co traballo tutelado realizado durante as sesións de clases prácticas. Desenvolverase de forma presencial (directamente na aula ou en titorías). Tamén poderá realizarse por medios telemáticos (correo electrónico, despacho virtual, videoconferencia, ...), baixo a modalidade de concertación previa.
Flipped Learning	Atención das consultas do estudantado relacionadas cos contidos teóricos da materia. Desenvolverase de forma presencial (directamente na aula ou en titorías). Tamén poderá realizarse por medios telemáticos (correo electrónico, despacho virtual, videoconferencia, ...), baixo a modalidade de concertación previa.
Resolución de problemas	Atención das consultas do estudantado relacionadas cos problemas e exercicios resoltos durante as sesións de clases prácticas. Desenvolverase de forma presencial (directamente na aula ou en titorías). Tamén poderá realizarse por medios telemáticos (correo electrónico, despacho virtual, videoconferencia, ...), baixo a modalidade de concertación previa.

Avaliación

	Description	Qualification	Training and Learning Results

Resolución de problemas	Entrega e corrección dos exercicios e problemas realizados durante as clases prácticas.	25	A1	B5	C6	D1 D5 D10 D12
Exame de preguntas obxectivas	Exame tipo test dos contidos teóricos da materia desenvolvidos mediante Flipped Learning.	40	A1	B2 B5 B8	C6	D1 D4 D12
Presentación	Exposición por parte do estudantado ante o docente e os seus compañeiros e compañeiras dos resultados obtidos no traballo tutelado.	35	A1	B2	C6	D1 D3 D4 D6 D8 D9 D10 D12

Other comments on the Evaluation

Primeira oportunidade: o conxunto de criterios de avaliación arriba exposto constitúe o sistema de avaliación continua na primeira oportunidade. É necesario alcanzar un mínimo de 3.5 (sobre 10) en cada proba para poder compensala e superar a materia. Poderá valorarse, adicionalmente, calquera contribución realizada polo estudantado nas sesións presenciais.

O estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

O estudantado que non siga o procedemento de avaliación continua deberá realizar un exame final, con parte teórica e parte práctica, que supoñerá o 100% da nota (**avaliación global**). A parte teórica consistirá nun exame de preguntas obxectivas (tipo test) e a parte práctica na resolución de problemas e exercicios e/ou dalgún caso relacionado coa temática do traballo tutelado. É necesario alcanzar un mínimo de 3.5 (sobre 10) en cada parte para poder compensala e superar a materia. Mediante este exame, avaliaranse todas as competencias da materia.

Segunda oportunidade (e convocatoria extraordinaria de fin de carreira): o estudantado que non supere a materia na primeira oportunidade, ten dúas opcións:

- Realizar un exame, con parte teórica e parte práctica, que supoñerá o 100% da nota. A parte teórica consistirá nun exame de preguntas obxectivas (tipo test) e a parte práctica na resolución de problemas e exercicios e/ou dalgún caso relacionado coa temática do traballo tutelado. É necesario alcanzar un mínimo de 3.5 (sobre 10) en cada parte para poder compensala e superar a materia. Mediante este exame, avaliaranse todas as competencias da materia. O alumnado que na primeira oportunidade seguiu a avaliación continua e quere elixir esta opción, debe comunicalo ao profesor, como máximo, tres semanas antes do exame.

- Conservar a nota obtida na Resolución de problemas (25%) e na Presentación (35%), sempre que sexa superior a 3.5 (sobre 10) en cada unha delas, e realizar só o Exame de preguntas obxectivas (40%). É necesario alcanzar un mínimo de 3.5 (sobre 10) nesta proba para poder compensala e superar a materia.

Se en calquera das dúas oportunidades non se aproba a materia por non alcanzar o mínimo nalgunha proba ou parte, e a puntuación total é igual ou superior a 5 (sobre 10), a cualificación en actas será 4.9 (sobre 10).

A concreción das actividades para realizar dependerá en gran medida do número de estudantes, medios para traballar en grupo, etc.

En caso de detección de plaxio ou copia en calquera das probas, a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

Na avaliación terase en conta non só a pertinencia a e calidade do contido das respostas, senón tamén a súa corrección lingüística.

As datas e horarios das probas de avaliación das diferentes convocatorias son as especificadas no calendario de probas de avaliación aprobado polo centro para o curso actual. En caso de conflito ou disparidade entre as datas dos exames, prevalecerán as sinaladas na páxina web da Escola.

IMPORTANTE: é obrigación do estudantado coñecer e seguir as instrucións relativas ás distintas probas de avaliación, tanto as contidas na Guía docente ou en calquera outro documento de organización da materia que o profesor poña á súa disposición, como as que se lle fagan chegar puntualmente a través das canles habituais (correo electrónico e/ou Moovi).

Bibliografía. Fontes de información

Basic Bibliography

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Recomendacións

Subjects that continue the syllabus

Dirección e xestión de proxectos/O07G410V01701

Prácticas en empresas/O07G410V01981

Sistemas da xestión da información/O07G410V01910

Other comments

É responsabilidade do estudantado coñecer e consultar os materiais dispoñibles na plataforma de teledocencia Moovi (novidades, documentos, cualificacións) e estar ao tanto dos avisos realizados polo docente.

IDENTIFYING DATA				
Tecnoloxía aeroespacial				
Subject	Tecnoloxía aeroespacial			
Code	O07G410V01205			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1	2c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Gómez San Juan, Alejandro Manuel			
Lecturers	Gómez San Juan, Alejandro Manuel			
E-mail	alejandromanuel.gomez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia proporciona unha introdución aos fundamentos da Enxeñaría Aeroespacial.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
B1	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.
B2	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.
B3	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.
B4	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.
B5	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.
B6	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.
B7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.
B8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.
C9	Comprender a globalidade do sistema de navegación aérea e a complexidade do tráfico aéreo.
C10	Comprender como as forzas aerodinámicas determinan a dinámica do voo e o papel das distintas variables involucradas no fenómeno do voo.
C13	Comprender a singularidade das infraestruturas, edificacións e funcionamento dos aeroportos.
C17	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.
C18	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.
C19	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

D9	Capacidade de traballo en equipo de carácter interdisciplinar
D12	Compromiso ético e democrático
D13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados previstos na materia

Expected results from this subject	Training and Learning Results			
Coñecemento xeral dos distintos sistemas propulsivos dos vehículos aeroespaciais	A1	B1 B2 B3 B4 B5 B7	C10 C17	D1 D3 D4 D6 D8 D9 D12
Coñecemento xeral da tecnoloxía aeroespacial	A1	B1 B2 B3 B4 B5 B6 B7 B8	C9 C10 C13 C17 C18 C19	D1 D3 D4 D6 D8 D9 D12 D13
Coñecemento, comprensión e aplicación dos fundamentos do voo atmosférico das aeronaves, incluíndo os lanzadores e misiles	A1	B1 B2 B3 B4 B6	C9 C10 C17 C18 C19	D1 D3 D4 D6 D8 D9 D13
Coñecemento, comprensión e aplicación dos fundamentos do voo orbital dos vehículos espaciais	A1	B1 B2 B3 B4 B7 B8	C10 C18	D1 D3 D4 D6 D8 D13
Coñecemento, comprensión e aplicación das distintas infraestruturas aeroportuarias e a navegación aérea	A1	B1 B2 B3 B4 B6 B7 B8	C9 C13 C17 C19	D1 D3 D4 D6 D8 D9 D13

Contidos

Topic	
Tema 1. Industria Aeroespacial	- Introdución á industria aeroespacial - Organizacións aeronáuticas e espaciais
Tema 2. Sistemas de propulsión	- Introdución á propulsión - Propulsión a hélice - Propulsión a chorro - Motores foguete
Tema 3. Arquitectura do avión	- Partes do avión - Materiais - Procesos de fabricación

Tema 4. Fundamentos do voo atmosférico	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 en plano vertical - Viraxe en plano horizontal - Actuacións en pista - Alcance - Autonomía
Tema 5. Aeronaves de á xiratoria	-Introdución ás aeronaves de ás rotatorias -Análise xeral da aerodinámica de rotores
Tema 6. Vehículos espaciais	- Introdución ao voo orbital - Análise de misión. - Análise de traxectorias de vehículos lanzadores - Tipos e clasificación de vehículos espaciais. - Análise xeral dos subsistemas.
Tema 7. Infraestruturas Aeroportuarias	- Sistema Aeroportuario - Lonxitude de pista de voo - Configuración de aeroportos - Terminais Aeroportuarias
Tema 8. Sistemas de navegación e circulación aéreas	- Seguridade na navegación aérea - Navegación e circulación aérea - Marco xurídico - Convenio de Aviación Civil Internacional - Marco organizativo - Sistema CNS - ATM - Marco técnico - Sistemas non autónomos. Axudas á navegación - Roteiros e cargas aéreas - Organización do espazo aéreo

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	35	57.5	92.5
Resolución de problemas	14	40	54
Exame de preguntas de desenvolvemento	1	0	1
Exame de preguntas de desenvolvemento	1.5	0	1.5

*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 estudantado, así como a presentar a materia.
Lección maxistral	O profesor exporá nas clases teóricas os contidos da materia. O estudantado terá textos básicos de referencia para o seguimento da materia.
Resolución de problemas	Actividade na que se formulan problemas e/ou exercicios relacionados coa materia. O alumnado debe desenvolver as solucións axeitadas ou correctas mediante a exercitación de rutinas, a aplicación de fórmulas ou algoritmos, a aplicación de procedementos de transformación da información dispoñible e a interpretación dos resultados. Adóitase empregar como complemento da lección maxistral.

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	Training and Learning Results			
Resolución de problemas	Entrega de coleccións de problemas propostos despois das sesións presenciais.	20	A1	B1 B2 B3 B4 B5 B6 B7 B8	C9 C10 C13 C17 C18 C19	D1 D3 D4 D6 D8 D9 D12 D13
Exame de preguntas de desenvolvemento	Realizarase un exame parcial sobre os contidos dos temas 1 ao 4. O exame poderá incluír preguntas tipo test, preguntas de desenvolvemento de resposta curta ou longa, e problemas.	40	A1	B1 B2 B3 B4 B6 B7 B8	C9 C10 C13 C17 C18 C19	D1 D3 D4 D8 D13
Exame de preguntas de desenvolvemento	Realizarase un exame parcial sobre os contidos dos temas 5 ao 8. O exame poderá incluír preguntas tipo test, preguntas de desenvolvemento de resposta curta ou longa, e problemas.	40	A1	B1 B2 B3 B4 B5 B7 B8	C9 C10 C13 C17 C18 C19	D1 D3 D4 D6 D8 D13

Other comments on the Evaluation

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

Primeira oportunidade.

(1) Estudantes que seguen o curso por Avaliación Continua:

Para poder superar a asignatura na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, en cada un dos dous exames parciais de avaliación continua, non inferior a 4.0.
-Entregar todas as prácticas e traballos da asignatura obtendo, como mínimo, unha nota de 3 en cada un deles.

-A nota media entre os 2 exames parciais (40% e 40%) e as prácticas (20%) debe ser superior a 5.0.

No caso de non cumprir ditas condicións a nota final será a resultante do mínimo da nota media de EC e de 4.0.

(2) Avaliación global:

O/A estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que establezca o centro para cada convocatoria**.**

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua. O estudantado poderá renunciar oficialmente á avaliación continua e realizar un só exame final, na data oficial. A nota obtida neste exame representará o 100% da nota final. O alumnado deberá superar o 5 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

O/a estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

Segunda oportunidade e Fin de Carrera

O alumnado que non superase a materia na primeira oportunidade poderá realizarán un exame que supoñerá o 100% da nota. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

En caso de detección de plaxio en calquera das probas (probas curtas, exames parciais ou exame final), a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do centro para os efectos oportunos.

Bibliografía. Fontes de información
Basic Bibliography
Complementary Bibliography
FRANCHINI, S Y LÓPEZ GARCÍA, O., **Introducción a la Ingeniería Aeroespacial**, Ed. Garceta, 2ª edición,
ANDERSON, J.D., **Introduction to flight**, Ed. McGraw-Hill, 5th edition,
ISIDORO CARMONA, **Aerodinámica y actuaciones de avión**, Ed. Paraninfo,
TORENBEEK, E Y WITTENBERG, H., **Flight Physics**, Springer,
F.J. SÁEZ NIETO, L PÉREZ SANZ Y V.F. GÓMEZ COMENDADOR, **La navegación aérea y el aeropuerto**, Fundación AENA,
M. GARCÍA CRUZADO, **Descubrir la operación de los aeropuertos**, Fundación AENA,
ENAIRE, **https://www.enaire.es**,

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	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@dma.uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this course is for students understand and master the basic techniques of complex variables and their applications, as well as partial differential equations and their applications, which are essential both for other courses in 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.			

Training and Learning Results

Code	
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C32	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.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning

Expected results from this subject

Expected results from this subject	Training and Learning Results		
LO1: Knowledge and understanding of the basic techniques of Complex Variable that areused in the field of the Aerospace Engineering.	B2	C32	D1 D3 D4 D5 D6 D8
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.	B2	C32	D1 D3 D4 D5 D6 D8

Contents

Topic

Complex variable	1. Analytical functions. 2. Integration in the complex field. 3. Series. 4. Residues and poles. 5. Z transform.
Fourier series	
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
Practices through ICT	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 aimed at engaging with and gathering information about the students, as well as introducing the course content.
Lecturing	The professor will present the the course content in theoretical classes, illustrating it with numerous examples and applications. Students will have basic reference texts to support their understanding of the material.
Problem solving	Approach, analysis, solution and discussion of a problem or exercise related to the material, both by the instructor and the students. This aims to illustrate and complete each lesson, helping students to acquire the necessary skills.
Autonomous problem solving	The student will have to resolve similar exercises to the realised in class to purchase the necessary capacities.
Practices through ICT	The student will use computer tools to resolve problems and exercises and apply the knowledge obtained in theory classes. Students will also have to do similar exercises to acquire the necessary skills.

Personalized assistance

Methodologies	**Description**
Lecturing	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course
Problem solving	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course
Autonomous problem solving	The professor will personally address students' questions. These will be handled face-to-face, particularly during problem-solving and laboratory sessions, as well as tutorials. Non-face-to-face queries will be addressed via the available online systems for the course

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	There will be a written test for each part of the course to evaluate the independent resolution of exercises and/or problems. Each test will have a weight of 30%. LO1, LO2	60	B2	C32	D1 D3 D4 D5 D6 D8

Essay questions exam	Completion of a final exam covering the content of the lectures and the problem-solving sessions.. LO1, LO2	40	B2	C32	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

The preferred mode of assessment is continuous assessment. The student has the right to opt for the overall assessment (100% of the grade on the official date) according to the procedure and deadline established by the centre for each exam call.

In any exam call it is necessary to obtain 5 points to pass the course. 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. If a grade lower than 2 points is obtained in any part, the final grade on the transcript will be the sum of both scores, capped at a maximum of 4.8 points.(*)

Second exam call evaluation:

An exam will assess the learning outcomes and competencies outlined in the teaching guide. This exam will account for 100% of the final grade.

If a student scores at least 3 points in one part (and less than 2 points in the other part), they may choose to retake only the failed part or the entire exam. The criterion indicated in (*) will also apply.

Exam-only comprehensive assesment procedure (any exam call):

The end-of-degree exam call follows the comprehensive assessment procedure.

An examination will be conducted to assess the learning outcomes and the competences indicated in the instructor's guide. This exam will constitute 100% of the mark for this exam call. The criterion indicated in (*) will also apply.

Evaluation dates:

The evaluation schedule officially approved by the EEAE is published on the website http://aero.uvigo.es/es/docencia/examenes/

Students are expected to demonstrate appropriate ethical behavior. If unethical behavior is detected (such as copying, plagiarism, unauthorized use of electronic devices, etc.), the student will be deemed not to meet the necessary requirements to pass the course. In such cases, the final grade for the academic year will be recorded as a failing grade (0.0).

Please be reminded of the prohibition on using mobile devices or laptops during exercises and practical sessions. According to Royal Decree 1791/2010 of December 30, which approves the Statute of the University Student, Article 13.2.d) specifies the duties of university students, including the obligation to:

'Abstain from using or cooperating in fraudulent activities during evaluations, assignments, or official university documents.'

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 to attend class and work on the content weekly.

IDENTIFYING DATA				
Enxeñaría eléctrica				
Subject	Enxeñaría eléctrica			
Code	O07G410V01302			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Enxeñaría eléctrica			
Coordinator	Albo López, Ana Belén			
Lecturers	Albo López, Ana Belén			
E-mail	aalbo@uvigo.es			
Web	http://aero.uvigo.es			
General description	Os obxectivos que se perseguen con esta materia son: - Adquisición dos coñecementos referidos a símbolos, magnitudes, principios, elementos básicos e leis da electricidade. - Coñecemento de técnicas e métodos de análise de circuítos en réxime estacionario senoidal. - Descrición de sistemas trifásicos. - Coñecemento dos principios de funcionamento e características das distintas máquinas eléctricas. - Coñecementos básicos das instalacións e sistemas eléctricos.			

Resultados de Formación e Aprendizaxe	
Code	
B1	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.
B4	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.
C17	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
RA1: Capacidade de analizar circuítos eléctricos e a súa aplicación na resolución de problemas reais		D1 D3 D4 D5 D6 D8 D13
RA2: Coñecemento básico de máquinas eléctricas e a súa utilización	C17	D1 D3 D4 D5 D6 D8 D13

RA3: Capacidade de deseñar e calcular instalacións eléctricas básicas	B1 B4	C17	D1 D3 D4 D5 D6 D8 D13

Contidos	
Topic	
Tema I: Introdución.	Elementos activos e pasivos dos circuítos eléctricos.
Tema II: Circuítos de Corrente Alterna: monofásicos e trifásicos.	Formas de onda. Comportamento dos elementos en corrente alterna. Elementos ideais e reais. Combinacións de elementos. Leis de Kirchoff. Teoremas de substitución, superposición, Thévenin e Norton. Potencias: complexa, aparente, activa, reactiva. Teorema de Boucherot. Sistemas trifásicos equilibrados: valores de liña e fase, redución ao monofásico equivalente.
Tena III: Fundamentos de Máquinas Eléctricas	Transformadores monofásicos e trifásicos: Constitución, funcionamento en baleiro e en carga, circuíto equivalente e índice horario. Máquinas asíncronas: Constitución, xeración do campo xiratorio, funcionamento en baleiro e en carga, circuíto equivalente, curvas características, manobras. Máquinas síncronas : Constitución, circuíto equivalente, funcionamento en baleiro e en carga, sincronización. Máquinas de corrente continua: Constitución, xeralidades, curvas características.
Tema IV: Fundamentos de instalacións eléctricas	Introdución aos sistemas eléctricos de potencia. Introdución ás instalacións eléctricas aeronáuticas. Instalacións eléctricas básicas: Elementos constitutivos. Previsión de cargas. Introdución ao cálculo de instalacións.
Prácticas	- Normas de Seguridade en laboratorio. - Corrente Continua: Asociación de elementos. - Corrente Alterna: Visualización e medida de ondas senoidais. Conexión serie - paralelo. Sistema trifásico equilibrado. - Máquinas Eléctricas: Ensaios - funcionamento de motores e/ou transformadores.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	20	40	60
Resolución de problemas	18.5	20	38.5
Resolución de problemas de forma autónoma	1.5	27.5	29
Prácticas de laboratorio	10	10	20
Exame de preguntas de desenvolvemento	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
Lección maxistral	O/a profesor/a exporá nas clases de grupos grandes os contidos da materia.
Resolución de problemas	Exporanse e resolveranse problemas e exercicios tipo nas clases de grupos grandes como guía para o estudantado.
Resolución de problemas de forma autónoma	É moi aconsellable que o/a estudante trate de resolver pola súa conta exercicios e cuestións da materia propostos polo profesorado.
Prácticas de laboratorio	Realizaranse no laboratorio montaxes prácticas correspondentes aos contidos vistos na aula, ou ben trataranse aspectos complementarios non tratados nas clases teóricas.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	O/a profesor/a atenderá persoalmente as dúbidas e consultas do estudantado.
Resolución de problemas	O/a profesor/a atenderá persoalmente as dúbidas e consultas do estudantado.
Prácticas de laboratorio	O/a profesor/a atenderá persoalmente as dúbidas e consultas do estudantado.

Resolución de problemas de forma autónoma	O/a estudante poderá asistir a titorías para resolver calquera cuestión relativa aos problemas propostos.

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas de forma autónoma	Realizaranse probas escritas e/ou traballos para avaliar a resolución de problemas de forma autónoma, ao longo da avaliación continua.	10	B1 B4	C17	D1 D3 D4 D5 D6 D8 D13
Prácticas de laboratorio	Valorarase positivamente a realización das prácticas e a resolución dun cuestionario referido á montaxe, resultados obtidos e interpretación dos mesmos. A realización de cada práctica e presentación do informe de prácticas valorarase entre 0 e 10 puntos. Para iso é imprescindible asistir á práctica o día e hora fixados ao comezo do curso. Non haberá recuperación de prácticas. A avaliación do conxunto de prácticas é a media aritmética das puntuacións obtidas. A non asistencia á práctica leva asociada a cualificación de cero puntos na práctica, independentemente que o/a estudante entregue o correspondente informe. Unha vez realizada cada práctica fixarase un prazo de presentación. Será imprescindible obter 5 puntos sobre 10 na primeira práctica sobre Normas de Seguridade en Laboratorio, para poder realizar o resto de prácticas en laboratorio.	20		C17	D1 D3 D4 D5 D6 D8
Exame de preguntas de desenvolvemento	Realizaranse dous exames ao longo da avaliación continua, cun peso do 35 % sobre a nota final cada un: - Primeiro exame: correspondente aos contidos de teoría de circuítos (Parte I). - Segundo exame: o día do exame final, correspondente aos contidos de máquinas e instalacións eléctricas (Parte II). Cada parte valorarase de 0 a 10 puntos.	70	B1 B4	C17	D1 D3 D4 D5 D8 D13

Other comments on the Evaluation

O **calendario de probas de avaliación** atópase publicado na páxina web http://aero.uvigo.eres/gl/docencia/exames.
Considérase por defecto que os/as estudantes seguen a materia mediante avaliación continua. O/A estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

Avaliación continua:

A nota final da avaliación continua obtense pola media ponderada dos ítem anteriores:
Nota = 0,10 x Resolución problemas de forma autónoma + 0,20 x Prácticas + 0,35 x Exame Parte I + 0,35 x Exame Parte II

De acadarse nalgunha das Partes I ou II de Exame unha nota inferior a 3 puntos sobre 10, aínda que a nota final sexa igual ou superior a 5,0 puntos, a nota máxima obtida será de 4,9 puntos.
Aqueles/as estudantes que non obtiveran unha calificación igual ou superior a 5 puntos sobre 10 no Exame da Parte I, poderán solicitar un exame adicional a continuación do exame final da primeira oportunidade. A puntuación final será obtenida neste exame adicional.

No exame de **segunda oportunidade**, o/a estudante manterá a nota de Resolución de problemas de forma autónoma e Prácticas, e realizará un Exame da Parte I e/ou II das que non se obtivera unha calificación igual ou maior de 5 puntos sobre 10, ou en caso de querer subir nota nas mesmas. A puntuación corresponderá coa obtida en segunda oportunidade.

Avaliación global primeira oportunidade, segunda oportunidade e fin de carreira:
Aqueles/as estudantes que soliciten a avaliación global para a primeira ou segunda oportunidade, ou se examinen de Fin de Carreira, realizarán un exame dividido en tres partes:

- Exame Parte I problemas correspondentes a teoría de circuítos, cun peso do 35 %
- Exame Parte II problemas correspondentes a máquinas e instalacións eléctricas, cun peso do 35 %
- Exame sobre cuestións teórico-prácticas da materia, cun peso do 30 %.

De acadarse nalgunha das Partes I e II do exame global de primeira e segunda oportunidade unha nota inferior a 3 puntos

sobre 10, aínda que a nota final sexa igual ou superior a 5,0 puntos, a nota máxima obtida será de 4,9 puntos. Conservarase para a **segunda oportunidade**, aquela **parte ou partes da avaliación global da primeira oportunidade superadas,** nas que obtiveron unha calificación igual ou maior de 5 puntos sobre 10. Por tanto, o/a estudante poderá:

- Presentarse ao resto de partes do exame. Neste caso conservarase a nota da parte ou partes superadas.
- Facer o exame completo, de querer subir nota nas partes xa superadas anteriormente. Neste caso, a puntuación corresponderase coa obtida en cada unha das partes do exame de segunda oportunidade.

Cada **nova matrícula** na materia supón unha **posta a cero** de todas as calificaciones obtidas en cursos anteriores. Con todo, aqueles estudantes que realizasen todas as prácticas de laboratorio do curso académico inmediatamente anterior, e obtivesen unha nota de 5 puntos sobre 10 de media nas mesmas, poderán solicitar o seu recoñecemento no prazo que se estableza ao comezo de curso.

Espérase que o estudiantado presente un **comportamento ético adecuado**. En caso de detección de copia en calquera das probas (avaliación continua ou exame final), a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

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Súarez Creo, J. , Albo López, E., **Ejercicios Resueltos de Fundamentos Electrotecnia**,

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

Jesús Fraile Mora, **Electrotecnia para ingenieros**, 978-84-1903-414-4, Ibergaceta Publicaciones, S.L., 2023

José García Trasancos, **Instalaciones eléctricas en media y baja tensión**, 978-84-2834-809-6, 8ª, Ediciones Paraninfo, 2020

Complementary Bibliography

Albo E., Albo A.B, Vázquez-Viso J., Míguez E., **Presentaciones Fundamentos Electrotecnia.**,

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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

A. Colmenar, J.L. Hernández, **Instalaciones Eléctricas en Baja Tensión. Diseño, cálculo, dirección, seguridad y montaje**, 978-84-9964-202-4, 2ª, Universidad Nacional de Educación a Distancia, 2012

Recomendacións

Subjects that are recommended to be taken simultaneously

Matemáticas: Métodos matemáticos/O07G410V01301

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

IDENTIFYING DATA

Termodinámica

Subject	Termodinámica			
Code	O07G410V01303			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Física aplicada			
Coordinator	González Salgado, Diego			
Lecturers	Cerdeiriña Álvarez, Claudio González Salgado, Diego Troncoso Casares, Jacobo Antonio			
E-mail	dgs@uvigo.es			
Web	http://aero.uvigo.es			
General description	O estudantado será instruido nos conceptos, leis e principais aplicacións da ciencia básica da Termodinámica.			

Resultados de Formación e Aprendizaxe

Code	
B2	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.
C8	Comprender os ciclos termodinámicos xeradores de potencia mecánica e pulo.
C16	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.
C19	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
RA1: Coñecemento, comprensión, análise e síntese dos principios e métodos da Termodinámica.	B2	C8 C16 C19	D1 D3 D4 D5 D6 D8
RA2: Coñecemento e comprensión dos dous primeiros principios da Termodinámica e a súa aplicación a sistemas abertos, tomando como exemplos algúns sistemas aeroespaciais típicos.	B2	C8 C16 C19	D1 D3 D4 D5 D6 D8
RA3: Coñecemento, comprensión e aplicación das relacións termodinámicas xeneralizadas, do equilibrio e estabilidade de sistemas simples compresibles e dos cambios de fase.	B2	C8 C16 C19	D1 D3 D4 D5 D6 D8

Contidos

Topic

Propiedades de equilibrio e procesos entre estados de equilibrio.	Enerxía e entropía en estados de equilibrio termodinámico. Temperatura, presión e potencial químico. Procesos termodinámicos: calor e traballo. Variables extensivas e intensivas e ecuacións de Euler e Gibbs-Duhem. Ecuacións de estado: coeficientes volumétricos e capacidades caloríficas. Potenciais termodinámicos e relacións de Maxwell.
Segundo Principio e máquinas térmicas.	Irreversibilidade e Segundo Principio. Manifestacións do Segundo Principio. Motores térmicos.
Transicións de fase.	Gases reais e transición líquido-gas. Diagramas de fase. Ecuación de Clapeyron. Tercer Principio.
Termofluídica.	Volumes de control. Conservación da masa. Traballo de fluxo e enerxía dun fluído en movemento. Análisis de enerxía de sistemas de fluxo estacionario. Dispositivos inxenieriles de fluxo estacionario.
Prácticas de laboratorio	Experimentos: Gas Ideal, Coeficiente Adiabático, Equilibrio Líquido-Vapor, Punto Crítico, Ferromagnetismo, Calor Específico dos Sólidos e Motores. Traballo computacional: Ecuación de van der Waals, Modelo de Ising e Simulación Numérica de Problemas de Fluxo en Termodinámica.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	39	87.5	126.5
Prácticas de laboratorio	11	10	21
Exame de preguntas de desenvolvemento	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
Lección maxistral	O/a profesora desenvolverá ao longo de cada hora de clase o mais relevante dos contidos da asignatura.
Prácticas de laboratorio	De xeito simultáneo ao desenrolo dos contidos de teoría e problemas nas sesións maxistrais, o estudantado realizará prácticas de laboratorio (experimentos y trabajo computacional) baixo a tutela do/a profesor/a. Fomentarase o traballo autónomo.

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	O/a profesor/a supervisará o traballo de cada estudante.

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Evaluarase o traballo levado a cabo durante a realización das prácticas e a memoria de prácticas presentada polo estudantado. Deberase obter unha nota superior a 5 puntos sobre 10 nesta avaliación.	10	B2	C8 C16 C19	D1 D3 D4 D5 D6 D8
Exame de preguntas de desenvolvemento	Realización de tres exames parciais ao longo do desenvolvemento das clases sobre teoría e problemas. A primeira proba terá un peso do 20%, a segunda do 30%, e a terceira do 40 %. As probas superaranse se se alcanza unha nota de 5 (sobre 10).	90	B2	C8 C16 C19	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

Avaliación global (decembro/xaneiro): o estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. Nesta opción, a avaliación de teoría e problemas constará dun exame fixado para a data oficial composto de tres probas escritas correspondentes ás tres probas parciais desenvolvidas na avaliación continua (descrita no cadro anterior). Nestas probas esixirase unha puntuación superior a 5 puntos sobre 10 en cada un dos exames realizados. A avaliación das prácticas de laboratorio será a mesma que no caso da avaliación contínua. A nota final obterase como media ponderada segundo as seguintes porcentaxes: 20% para o primeiro exame parcial, 30%

para o segundo parcial, 40% para o terceiro e 10% para o laboratorio. No caso de que a nota ponderada supere o 5 sen que así o fixesen as notas individuais, a nota outorgada será de 4.9.
Avaliación continua (decembro/xaneiro): o estudantado que non superase algunha (ou varias) das probas escritas realizadas durante a avaliación continua (descrita no cadro anterior), terá outra oportunidade no exame fixado para a data oficial. As características deste exame foron descritas no párrafo anteior. O estudantado deberá presentarse a parte ou ás partes non superadas. Nestas probas esixirase unha puntuación superior a 5 puntos sobre 10 en cada un dos exames realizados. A nota final obterase como media ponderada segundo as seguintes porcentaxes: 20% para o primeiro exame parcial, 30% para o segundo parcial, 40% para o terceiro e 10% para o laboratorio. No caso de que a nota ponderada supere o 5 sen que así o fixesen as notas individuais, a nota outorgada será de 4.9.
Para superar a materia na avaliación de segunda oportunidade ou fin de carreira requerirase obter unha cualificación superior a 4.5 puntos sobre 9 nunha proba escrita sobre os contidos de teoría e problemas e unha cualificación superior a 0.5 puntos sobre 1 nunha proba escrita sobre os contidos de laboratorio.O estudantado que levara a cabo as prácticas previamente e foxe evaluado positivamente non necesitará realizar o exame de prácticas conservando a nota previa Se non se cumple algún dos requisitos previos e, nembargantes, a suma das dúas notas supera o 5, o alumno considerarase suspenso cunha nota final de 4.9.

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

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Y. A. Cengel, M. A. Boles, **Termodinámica**, 8ª edición, McGraw-Hill, 2015
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Recomendacións
Subjects that continue the syllabus
Mecánica de fluídos/O07G410V01402

Subjects that it is recommended to have taken before
Física: Física 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	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Gomez Barreiro, Silvia			
Lecturers	Gomez Barreiro, Silvia			
E-mail	sgomez@uvigo.es			
Web	http://dept05.webs.uvigo.es/			
General description	Esta materia é unha introdución á ciencia dos materiais. O obxectivo é ofrecer ao estudantado unha visión xeral dos distintos tipos de materiais, as súas propiedades e aplicacións fundamentais.			

Resultados de Formación e Aprendizaxe

Code	
B1	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.
C11	Comprender as prestacións tecnolóxicas, as técnicas de optimización dos materiais e a modificación das súas propiedades mediante tratamentos.
C18	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.
C19	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
RA2: Coñecemento xeral dos distintos materiais metálicos utilizados na enxeñaría, como son os aceiros e as aliaxes lixeiras.	B1	C11 C18 C19	D1 D3 D4 D5 D6 D8 D13
RA3: Coñecemento xeral dos distintos materiais non metálicos utilizados na enxeñaría, como son os materiais poliméricos, os materiais cerámicos, os materiais compostos, etc.	B1	C11 C18 C19	D1 D3 D4 D5 D6 D8 D13

Contidos

Topic	
Tema 1.Introdución	Introdución a ciencia dos materiais. Relación entre estructura e propiedades dos materiais. Tipos de materiais.
Tema 2. Propiedades mecánicas básicas.	Tracción, compresión, dureza, tenacidade. Ensaios mecánicos normalizados.

Tema 3. Estrutura cristalina	Materiais cristalinos e non cristalinos. Estruturas cristalinas. Celas unitarias. Sistemas cristalinos. Anisotropía. Direccións cristalográficas. Planos cristalográficos.
Tema 4. 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: dislocacións. Dislocacións e deformación plástica. Deformación por maclado. Endurecemento por acritude. Endurecemento por redución do tamaño de gran. Endurecemento por solución sólida. Defectos interfaciais: límite de gran. Defectos volumétricos.
Tema 5. Diagramas de fase.	Solidificación. Nucleación homoxénea e heteroxénea. Crecemento. Curva de enfriamento. 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 6. Aleaciones Férreas y Tratamientos Térmicos	(*)Aleaciones férreas: aceros y fundiciones. Cambios en la microestrutura y en las propiedades de las aleaciones Fe-C. Solidificación fuera del equilibrio. Tratamientos térmicos.
Tema 6. Aliaxes férreas e tratamentos térmicos.	Aleacións férreas: aceiros e fundicións. Cambios na microestrutura e nas propiedades das aleacións Fe-C. Solidificación fóra do equilibrio. Tratamentos térmicos.
Tema 7. Aliaxes lixeiras. Aliaxes de Aluminio.	Aliaxes lixeiras. Aliaxes de Aluminio. Tipos e nomenclatura. Mecanismos de endurecemento nas aliaxes de aluminio.
Tema 8. Materiais poliméricos.	Tipos de polímeros. Cristalinidade. Comportamento térmico: fusión e transición vítrea. Comportamento mecánico. Viscoelasticidade. Conformado.
Tema 9. Materiais cerámicos.	Silicatos. Comportamento tensión-deformación. Refractarios. Abrasivos. Cerámicas avanzadas. Vidros. Vitrocerámicas. Conformado e procesado de cerámicas.

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	22	45.5	67.5
Resolución de problemas	7.5	22.5	30
Prácticas de laboratorio	15	19.5	34.5
Exame de preguntas obxectivas	2.5	0	2.5
Traballo	2.5	10	12.5
Exame de preguntas obxectivas	2	0	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
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 estudantado deberá ser capaz de resolver problemas de forma autónoma.
Prácticas de laboratorio	Realizaranse actividades para a aplicación práctica dos coñecementos adquiridos nas sesións de teoría. Levaranse a cabo no laboratorio, facendo uso de equipos especializados e seguindo a normativa aplicable.

Atención personalizada

Methodologies	Description
Lección maxistral	Tempo que o profesor reserva para atender e resolver dúbidas ao estudantado 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 estudantado 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 estudantado 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 estudantado 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.
Prácticas de laboratorio	Tempo que dedica o profesor á resolución de dúbidas que se poidan expor durante a realización das prácticas de laboratorio e durante a elaboración dos correspondentes informes.
Tests	**Description**
Traballo	Tempo de titorías adicada a orientación e resolución de dúbidas na elaboración dos traballos.

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Valorarase a entrega de informes do contido desenvolvido nas prácticas de laboratorio.	25	B1	C11 C18 C19	D1 D3 D4 D5 D6 D8 D13
Exame de preguntas obxectivas	Proba de avaliación. A proba constará de preguntas de resposta curta, problemas e/ou preguntas tipo test.	25	B1	C11 C18 C19	D1 D3 D4 D5 D6 D8 D13
Traballo	Presentación oral por grupos dun tema proposto durante o desenvolvemento da materia.	10	B1	C11 C18 C19	D1 D3 D4 D5 D6 D8 D13
Exame de preguntas obxectivas	Proba de avaliación. A proba constará de preguntas de resposta curta, problemas e/ou preguntas tipo test	40			

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

Avaliación continua: (sistema de avaliación predeterminado). Constará de distintas probas realizadas durante a impartición da asignatura e unha proba final na data oficial, como se indica na táboa anterior, que recolle a porcentaxe de cada proba na nota total. A continuación preséntase un resumo:
5% Entrega de informes, asistencia e participación en prácticas. 10% Exposición oral e defensa do traballo en grupo. 20% Exame escrito das sesións prácticas. 25%* Exame parcial I dos contidos teóricos da primeira parte da materia (Realizarase aproximadamente á metade do cuadrimestre) 40%* Exame parcial II dos contidos teóricos da segunda parte, nos que se considerará a comprensión global da asignatura (realizarase na data oficial do exame da 1ª edición fixada polo centro)
*o alumnado que deba presentarse á 2ª edición do exame (na data oficial fixada polo centro) realizará un único exame escrito que avaliará a totalidade dos contidos teóricos (temario avaliado nos Exames parciais I e II) e que representará o 65% da nota. Conservará a cualificación das tres probas de prácticas (35%)
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. A nota da avaliación continua conservarase para o exame de segunda oportunidade.

Avaliación global: nas dúas edicións oficiais, o alumnado que renuncie á avaliación continua consonte o procedemento e no prazo establecido polo centro, seguirá un proceso de avaliación global. Constará dun único exame escrito no que serán avaliados o seu coñecemento de todos os contidos teóricos e prácticos da asignatura, eque terá un peso do 100% da nota final.
Para superar a asignatura, segundo o sistema de avaliación global: debe acadarse un mínimo de 5 sobre 10.

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).As probas de avaliación continua realizaranse dentro do horario lectivo.

O estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. A/o estudante ten dereito a optar á avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. No caso de optar pola avaliación global, a materia avaliarase cun exame que incluirá contidos desenvolvidos nas clases teóricas e os contidos e problemas desenvolvidos durante as prácticas.
A mesma metodoloxía aplicarase para a avaliación na convocatoria de fin de grao.
Comportamento ético: Esperase que o alumno presente un comportamento ético adecuado na totalidade das actividades do curso, atendendo especialmente ao indicado nos Artigos 39, 40, 41 e 42 do Regulamento sobre a avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do estudantado da Universidade de Vigo (aprobado no claustro do 18 de abril de 2023).

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

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

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

Mecánica clásica

Subject	Mecánica clásica			
Code	O07G410V01305			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Física aplicada			
Coordinator	Cerdeiriña Álvarez, Claudio			
Lecturers	Cerdeiriña Álvarez, Claudio Troncoso Casares, Jacobo Antonio			
E-mail	calvarez@uvigo.es			
Web	http://aero.uvigo.es			
General description	O estudantado será instruido nos conceptos, leis e principais aplicacións da ciencia básica da mecánica clásica.			

Resultados de Formación e Aprendizaxe

Code	
B1	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.
B2	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.
C15	Coñecemento adecuado e aplicado á Enxeñaría de: Os principios da mecánica do medio continuo e as técnicas de cálculo da súa resposta.
C19	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
RA1: Coñecemento, comprensión e aplicación da estática e da evolución dinámica de sistemas de partículas e sólidos ríxidos no ámbito da Mecánica Clásica	B1 B2	C15 C19	D1 D3 D4 D5 D6 D8
RA2: Coñecemento, comprensión e aplicación dos métodos de análise cinemático e dinámico empleados neste contexto.	B1 B2	C15 C19	D1 D3 D4 D5 D6 D8
RA3: Coñecemento, comprensión e aplicación de aspectos mais concretos da Mecánica Clásica como, por exemplo, a teoría de percusións.	B1 B2	C15 C19	D1 D3 D4 D5 D6 D8

Contidos

Topic	
Cinemática	Sistemas de referencia inerciais e non inerciais Cambio de orientación dun sistema de referencia: cosenos directores, ángulos de Euler, parámetros de Euler, parámetros de Cayley-Klein. Campo de velocidades e aceleracións. Composición de velocidades e aceleracións.
Ecuacións xerais da mecánica	Ecuación da dinámica de Newton para unha partícula e un sistema de partículas. Formulación de Lagrange: cálculo de variacións, coordenadas xeneralizadas, principio de D'Alembert, principio de Hamilton, ecuacións de Euler-Lagrange, coordenadas cíclicas, teoremas de conservación.
Dinámica da partícula	Movemento oscilatorio Forzas centrais e gravitación Movemento ligado
Dinámica do sólido ríxido	Centro de masas e tensor de inercia. Momento angular e enerxía cinética do sólido ríxido. Ecuacións da dinámica para sólido ríxido. Sólido cun eixo fixo Sólido cun punto fixo Sólido libre.
Estática	Estática Newtoniana de sólidos Estática analítica de sólidos
Percusións	Ecuacións xerais da percusión en sólidos Estudo de diferentes tipos de percusións
Prácticas de laboratorio	Ecuacións de movemento do xiróscopo Oscilacións amortiguadas e forzadas Ondas mecánicas Péndulos acoplados e péndulo de Kater. Medida da dinámica dun sistema cunha cámara de alta velocidade Resolución numérica de problemas de dinámica con Matlab.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	38	89.5	127.5
Prácticas de laboratorio	12	8	20
Exame de preguntas de desenvolvemento	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
Lección maxistral	O profesorado explicará ao longo de cada hora de clase o máis relevante dos contidos da materia.
Prácticas de laboratorio	Unha vez desenvolvidos os contidos de teoría e problemas correspondentes ás sesións maxistrais, o estudantado realizarán prácticas de laboratorio baixo a tutela do profesor. Fomentarase o traballo autónomo do estudantado.

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	O profesorado supervisará o traballo de cada estudante

Avaliación

	Description	Qualification	Training and Learning Results
Prácticas de laboratorio	Evaluarase o traballo levado a cabo durante a realización das prácticas e a memoria de prácticas presentada polo estudantado. Deberase obter unha nota superior a 5 puntos sobre 10 nesta avaliación.	20	B1 C15 D1 B2 C19 D3 D4 D5 D6 D8

Exame de preguntas de desenvolvemento	Realización de dous exames sobre teoría y problemas ao longo do desenvolvemento das clases. Cada exame será liberatorio, terá un peso do 40% na nota final e requerirase alcanzar unha nota de 5 sobre 10 para superalo.	80	B1 B2	C15 C19	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

O día do exame final poderán recuperarse os dous exames realizados ao longo do cuadrimestre. Os/as estudantes poderán elexir qué probas facer para mellorar as súas cualificacións e consignarase sempre a máxima nota acadada entre o exame feito ao longo do cuadrimestre e a recuperación.

No caso de que a cualificación media sexa maior que 5 sin superarse o 4 nalgunha das dúas probas individuais, a nota outorgada será 4.9.

As evaluacións de segunda oportunidade e de fin de carreira terán os mesmos criterios que as recuperacións do exame final correspondente á primeira oportunidade.

O/A estudante ten dereito a optar pola evaluación global según o procedemento e prazo que estableza o centro para cada convocatoria. A evaluación global farase mediante un exame que abarque os contidos da materia, incluindo cuestións relativas á parte de laboratorio.

O calendario de probas de evaluación 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

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

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

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

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

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

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

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

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

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

Complementary Bibliography

Recomendacións

Subjects that continue the syllabus

Mecánica de fluídos/O07G410V01402
Resistencia de materiais e elasticidade/O07G410V01405

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103
Matemáticas: Álxebra lineal/O07G410V01102
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201

IDENTIFYING DATA

Mathematics: Statistics

Subject	Mathematics: Statistics			
Code	O07G410V01401			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	2nd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	González Rodríguez, Brais			
Lecturers	González Rodríguez, Brais			
E-mail	brais.gonzalez.rodriguez@uvigo.gal			
Web	http://aero.uvigo.es			
General description	This subject is designed to introduce students to stochastic thinking and the modelling of real problems. In many fields of science, and aerospace engineering is no exception, decisions must be taken in many cases in contexts of uncertainty. These decisions involve prior processes such as obtaining as much information as possible, determining the sources of error and modelling the situations. This is where this subject is located. It aims to introduce the bases for a detailed analysis of the available information. Finally, this subject contributes to the development of analytical and mathematical thinking which will be extremely useful in future professional practice. English language is used in written materials. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C1	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.
D1	Capability of analysis, organization and planning.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Knowledge, understanding and application of statistical models used within the scope of the Engineering.	B2	C1	D1 D3 D4 D5 D6 D8
Knowledge, understanding and application of sampling theory, decision theory and regression models. regression models.	B2	C1	D1 D4 D5 D8

Contents

Topic	
Theory of Probability	Sample space, events and probability, combinatorics. Conditional probability, independence of events Product rule, total probabilities and Bayes' theorem

Random variables	One-dimensional and two-dimensional random variables: characteristic measures Main discrete random variables Main continuous random variables
Statistical inference	Introduction to statistical inference Point and interval estimation Parametric hypothesis testing Non-parametric tests: goodness-of-fit, position, independence and homogeneity tests
Regression	Introduction to regression models. Simple linear regression: estimation, adjustment and prediction. Multiple linear regression

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	18	38	56
Problem solving	15.5	41.5	57
Practices through ICT	15.5	18	33.5
Laboratory practice	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 aimed at making contact with and gathering information about students, as well as introducing the subject. introducing the subject matter.
Lecturing	Presentation by the teaching staff of the contents of the subject to be studied, theoretical bases, theoretical theoretical bases, exercises or practices to be carried out by the student.
Problem solving	Resolution of problems, readings, summaries, diagrams and questions on each of the topics of the subject programme. of the subject syllabus. Resolution of the exercises on the blackboard. The following software will be used free statistical software R
Practices through ICT	Resolution of exercises with the help of the computer. Use will be made of the free statistical software R

Personalized assistance

Methodologies	**Description**
Lecturing	Attention and resolution of doubts to students in relation to the different activities of the subject. Tutoring sessions may be carried out by telematic means (e-mail, videoconference, etc.) by prior arrangement.
Problem solving	Attention and resolution of doubts to students in relation to the different activities of the subject. Tutoring sessions may be carried out by telematic means (e-mail, videoconference, etc.) by prior arrangement.
Practices through ICT	Attention and resolution of doubts to students in relation to the different activities of the subject. Tutoring sessions may be carried out by telematic means (e-mail, videoconference, etc.) by prior arrangement.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	Written tests and/or assignments will be carried out to evaluate the resolution of exercises and/or problems in an resolution of exercises and/or problems in an autonomous way, as well as active participation.	60	B2	C1	D1 D3 D4 D5 D6 D8
Practices through ICT	Partial tests will be carried out throughout the four-month period, which will be used to which are intended to to check if the student has achieved the basic competences of the subject. basic competences of the subject.	40	B2	C1	D1 D3 D4 D5 D8

Other comments on the Evaluation

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

CRITERIA FOR CONTINUOUS ASSESSMENT AT THE FIRST CALL:

Partial tests will be carried out at the end of each topic (in no case will the weight of any single test exceed 40% of the total grade). In order for a student to pass the course on the first attempt through continuous assessment, they must obtain a minimum final grade of 5 points by adding the weighted scores, provided that no individual test score is below 3 out of 10. If the student scores below 3 in any test, the final grade will be the lower of the weighted average of the scores obtained and 3.

NON-CONTINUOUS ASSESSMENT CRITERIA (exam-only assessment):

The non-continuous assessment consists of a single exam in which all the content covered throughout the course will be evaluated (100% of the final grade). It will involve solving theoretical and practical problems, with the use of the statistical software R in some questions. The maximum duration of the exam will be 3 hours. Any student may take this exam, but doing so will result in the loss of any partial grades, and the grade obtained on this exam will count as the first assessment opportunity.

The training and learning results assessed assessed and expected results from the subject are all as described.

CONTINUOUS AND EXAM-ONLY ASSESSMENT CRITERIA IN THE 2ND CALL AND END-OF-PROGRAM CALL:

The assessment system in the 2nd call and end-of-program call for all students (with continuous/exam-only assessment or without assessment in the 1st call) will be the same as the one used in the 1st call for students without continuous assessment.

The calendar of assessment tests officially approved by the EEAE's "Xunta de Centro" is published on the following website the website of the centre http://aero.uvigo.es/gl/docencia/exames

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

Sources of information

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,

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, 2022

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

Students are expected to display appropriate ethical behaviour. Plagiarism is considered serious dishonest behaviour. In the event of detecting inappropriate ethical behaviour (copying, plagiarism, use of unauthorised electronic devices, and others), it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade for the current academic year will be a fail (0.0) and the incident will be reported to the corresponding academic authorities for prosecution

IDENTIFYING DATA				
Mecánica de fluídos				
Subject	Mecánica de fluídos			
Code	O07G410V01402			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	#EnglishFriendly Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Paz Penín, María Concepción Rodríguez Pérez, Luis			
Lecturers	Paz Penín, María Concepción Rodríguez Pérez, Luis			
E-mail	cpaz@uvigo.es lurodriguez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Coñecemento, comprensión e aplicación de conceptos e técnicas da Mecanica de Fluidos de Enxeñaría Aeroespacial. Introduccion os movementos laminares e turbulentos, en rexime incompresible e compresible. Materia do programa English Friendly. Os/as estuidantes internacionais poderán solicitar: a) materiais e referencias bibliográficas para o seguimento da materia en inglés, b) atender as titor´ías en inglés, c) probas e avaliacións en inglés.			

Resultados de Formación e Aprendizaxe	
Code	
C16	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.
C18	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.
C19	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.
C28	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
Coñecemento, comprensión e aplicación dos conceptos e leis que gobernan os movementos dos fluídos.	C16 C18 C19 C28	D1 D3 D4 D5 D6 D8
Nova	C16 C18 C19 C28	D1 D4 D5 D8

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 irrotacionales. 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. Forma diferencial da ecuación da enerxía. Lei de Fourier. Fluxo de calor por condución. Ecuación de Bernoulli. Aplicacions. Resumo das ecuacións de Mecánica de Fluídos. Condicións iniciais. Condicións de contorno máis usuais. Condición de non deslizamiento.
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 Fluidodinámica	Tema 5. Análise Dimensional e Semellanza Fluidodinámica: 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. Coxinete cilíndrico, lubricación con gases, patín rectangular, 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

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. Ensaio en banco aerodinámico: Medición de velocidades en chorro de aire. Comprobación da ecuación de Bernoulli. Ensaio en túnel de vento: Distribución de presións arredor dun cilindro. Cálculo do coeficiente de resistencia. Distribución de presións arredor dun perfil de á. Cálculo do coeficiente de sustentación. Medición tubo de Prandtl. Medición con tubo Pitot.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	8.5	38.5
Resolución de problemas	20	17.5	37.5
Resolución de problemas de forma autónoma	0	71.5	71.5
Exame de preguntas obxectivas	1.5	0	1.5
Resolución de problemas e/ou exercicios	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	Exposición da teoría Translación de problemas de fluídos a modelos matemáticos
Resolución de problemas	Formulación e/ou resolución de modelos aplicados fluxos de fluídos
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios de forma autónoma por parte do estudantado para comprender e ser capaz de expor e resolver correctamente os distintos modelos de fluídos estudados no curso

Atención personalizada

Methodologies	Description
Resolución de problemas	En clases prácticas na aula, titorizadas por o profesor
Resolución de problemas de forma autónoma	Promoverase a resolucion de problemas de forma autónoma, titorizando de forma personalizado (nas titorias) os resultados e os métodos de resolución

Avaliación

	Description	Qualification	Training and Learning Results	
Resolución de problemas	Entrega de problemas propostos na folla de actividade ou de forma directa nas clases.	20	C16 C18 C19 C28	D1 D3 D4 D5 D6
Exame de preguntas obxectivas	Realizarase un exame escrito cara á metade do curso e outro a finais sobre o contido abordado nas sesións maxistrais e nas sesións de resolución de problemas até a data, cun peso do 40% da nota na materia.	40	C16 C18 C19 C28	D1 D3 D4 D5 D6 D8
Resolución de problemas e/ou exercicios	Realizarase un exame ao final do curso sobre o contido abordado nas sesións maxistrais e nas sesións de resolución de problemas, cun peso do 40% sobre a nota final na materia.	40	C16 C18 C19 C28	D1 D3 D4 D5 D6 D8

Other comments on the Evaluation

O/a estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

Os alumnos que non renuncien específicamente, dacordo co párrafo anterior, se lles aplicará, como evaluación continua a nota acadada durante o curso. Que suporá un máximo dun 20% sobre a nota total

Os exames parciais liberatorios ou finais: ordinario, segunda oportunidade e fin de carreira, ten un peso do 80%. O cal quere decir que o outro 20% e o acadado na evaluación continua, salvo que renuncie a ela, nese caso, terá que solicitalo según a normativa da escola e despois facer un exame mais longo, no sentido que terá mais exercicios ata un valor dun 20% equivalente a evalución continua.

Todas as cualificacions obtidas previamente en todas e cada unha das probas de avaliación continua e parciais, poden gardarse para as seguintes probas: ordinaria, segunda oportunidade e exames de fin de carreira.

Esperase que o alumnado amose un comportamento ético axeitado. No caso de detectar comportamentos pouco éticos (copia, plaxio, uso de dispositivos electrónicos non autorizados, por exemplo), considérase que non reune os requisitos necesarios para superar a materia. Segundo o tipo de comportamento pouco ético detectado, pódese cponcluir que o alumno/a non acadou as habilidades necesarias.

Non se permitirá o uso de ningún dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir na aula de exames un dispositivo electrónico non autorizado terá a consideración de motivo de non superación da materia no curso académico e quedará suspendida a nota global (0.0).

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, **Fluid Mechanics**, 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	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría de sistemas e automática Tecnoloxía electrónica			
Coordinator	García Rivera, Matías			
Lecturers	Balvís Outeiriño, Eduardo Castro Miguéns, Carlos García Rivera, Matías Sotelo Martínez, José Manuel			
E-mail	mgrivera@uvigo.es			
Web	http://aero.uvigo.es			
General description	Nesta asignatura vense conceptos básicos sobre Electrónica e Regulación Automática			

Resultados de Formación e Aprendizaxe	
Code	
B1	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.
B4	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.
C17	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.
C18	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
RA1: Coñecemento e comprensión do funcionamento dos dispositivos electrónicos	B1	C17	D1 D4 D5 D8
RA2: Coñecemento da estrutura básica dos sistemas electrónicos baseados en circuítos dixitais e microprocesadores e a súa aplicación en enxeñaría aeroespacial.	B1 B4	C17	D1 D4 D5 D8
RA3: Coñecemento xeral dos distintos tipos de sensores e sistemas electrónicos de acondicionamento e adquisición de datos no ámbito das aplicacións aeroespaciais.	B1	C17	D4 D5 D8
RA4: Coñecemento da estrutura dos convertidores electrónicos de potencias e das fontes de alimentación.		C17	D1 D4 D5 D8

RA5: Coñecemento xeral sobre o modelado dinámico de sistemas.	B1	C18	D1 D3 D4 D5 D6 D8
RA6: Coñecemento, análise e aplicación das accións básicas de control.	B1	C18	D1 D3 D4 D5 D6 D8
RA7: Coñecemento e comprensión sobre o deseño de reguladores no dominio da frecuencia.	B1 B4	C18	D1 D3 D4 D5 D6 D8

Contidos	
Topic	
Tema 1: Dispositivos electrónicos	1.1 Diodos rectificadores, zener e emisores de luz 1.2 Transistores bipolares. 1.3 Transistores Mosfet, de canle N e de canle P. 1.4 Amplificadores operacionales 1.5 Comparadores analóxicos
Tema 2: Electrónica dixital e estrutura de microcontroladores	2.1 Sistema de numeración binario. 2.2 Álxebra de Boole bivalente ou de conmutación. 2.3 Variables e funcións lóxicas 2.4 Portas lóxicas. Implementación de funcións lóxicas utilizando portas lóxicas. 2.5 Bloques funcionais combinacionales 2.6 Circuítos secuenciales. Bloques funcionais 2.7 Conceptos básicos sobre microcontroladores
Tema 3: Sensores e circuítos de acondicionamento e de adquisición de datos	3.1 Conceptos básicos sobre sensores 3.2 Circuítos acondicionadores de sinal 3.3 Conceptos básicos sobre convertidores A/D
Tema 4: Convertidores de potencia e fontes de alimentación.	4.1 Tipos de convertidores modulados por ancho de pulso 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			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	28	61.5	89.5
Resolución de problemas	10	0	10
Resolución de problemas de forma autónoma	0	18	18
Prácticas de laboratorio	12	15	27
Resolución de problemas e/ou exercicios	2.5	0	2.5
Informe de prácticas, prácticum e prácticas externas	0	3	3

*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 do 1 ao 4 indicados no apartado Contidos desta guía), nas clases de teoría explícanse conceptos básicos e resolvense exercicios sobre os distintos contidos que abarcan esta primeira parte da materia. Para a exposición dos conceptos teóricos utilizarase tanto o proxector de vídeo como o encerado. É necesario facer un traballo persoal posterior a cada clase dedicado a estudar os conceptos expostos na mesma así como a repasar os conceptos expostos en clases previas. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas clases de teoría exporanse ao estudantado os contidos desta parte da materia.
Resolución de problemas	En relación á parte I da materia (temas do 1 ao 4 indicados no apartado Contidos desta guía), nas clases prácticas resolveranse exercicios sobre os contidos vistos nas clases de teoría.
Resolución de problemas de forma autónoma	En relación á parte I da materia (temas do 1 ao 4 indicados no apartado Contidos desta guía), ao longo do período de docencia desta parte da materia publicaranse en Moovi (https://moovi.uvigo.gal/) varios boletíns de exercicios que as persoas que cursen esta materia deberán resolver durante o tempo destinado a actividades non presenciais
Prácticas de laboratorio	En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas prácticas de laboratorio se formularán, analizarán, resolverán e debaterán problemas 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 estudantado pode consultar as dúbidas sobre os devanditos temas durante as clases de teoría así como durante as horas destinadas a titorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e na páxina da materia, en Moovi (http://moovi.uvigo.gal). En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o estudantado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.
Prácticas de laboratorio	En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o estudantado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.
Resolución de problemas de forma autónoma	En relación á parte I da materia (temas do 1 ao 4 indicados no apartado Contidos desta guía), o estudantado pode consultar en titorías as dúbidas sobre os exercicios propostos como actividades non presenciais. O horario de titorías está publicado na porta do despacho 312 e na páxina da materia, en Moovi (http://moovi.uvigo.gal).
Resolución de problemas	En relación á parte I da materia (temas do 1 ao 4 indicados no apartado Contidos desta guía), o estudantado pode consultar tanto durante as clases como en titorías as dúbidas que teña sobre os exercicios resoltos nas clases dedicadas a resolver exercicios.

Avaliación

	Description	Qualification	Training and Learning Results
Resolución de problemas de forma autónoma	En relación á primeira parte da materia (temas do 1 ao 4 indicados no apartado Contidos desta guía), durante o período de clases o alumnado deberá resolver unha serie de exercicios de forma autónoma. A influencia na nota final detállase no apartado 'Outros comentarios sobre a Avaliación' Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	10	
Prácticas de laboratorio	Na parte de AUTOMATICA (temas 5 a 9 indicados no apartado Contidos desta guía): Realizarase unha proba sobre as contidos/competencias/resultados de aprendizaxe das clases de GRUPOS REDUCIDOS/LABORATORIO. Esta proba é obrigatoria, representa un 10% da nota final e require un mínimo de 5 sobre 10. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	10	B1 C17 D1 B4 C18 D3 D4 D5 D6 D8

Resolución de problemas e/ou exercicios	En relación a la primera parte de la asignatura (temas del 1 al 4 indicados en el apartado Contenidos de esta guía), en la última semana de clase de esta parte de la asignatura se realizará un examen. En dicho examen se plantearán diversas cuestiones y problemas sobre la materia explicada a lo largo del cuatrimestre hasta dicho momento. La influencia en la nota final se detalla en el apartado 'Otros comentarios sobre la Evaluación'. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	40	B1 C17 D1 B4 D4 D5 D8
Informe de prácticas, prácticum e prácticas externas	Na parte de AUTOMATICA (temas 5 a 9 indicados no apartado Contidos desta guía): Entrega dun informe de prácticas para avaliar a asistencia e participación activa nas clases teóricas e prácticas e nas titorías. Esta entrega non é obrigatoria e representa un 5% da nota final. Resultados avaliados da aprendizaxe: RA5, RA6 e RA7.	5	B1 C17 D1 B4 C18 D3 D4 D5 D6 D8

Other comments on the Evaluation

Esta materia consta de duas partes. Na parte I (temas do 1 ao 4) vense conceptos básicos de Electrónica e na parte II (temas do 5 ao 9) vense conceptos sobre Regulación Automática. O peso de cada parte na nota final da materia é dun 50%. A nota final en calquera oportunidade de avaliación (ordinaria, extraordinaria e Fin de Carrera) obterase sumando as notas (entre 0 e 5 puntos) obtidas en cada unha das dúas partes da materia. Para aprobar a materia en calquera edición da acta será necesario obter en cada unha das partes unha nota igual ou superior a 2,5puntos (máximo 5 puntos). No caso de obter nalgunha das partes unha nota inferior a 2,5 puntos (máximo 5 puntos), a nota final que figurará na acta será a suma das notas obtidas en ambas as partes limitándoa a un máximo de 4 puntos. As persoas matriculadas nesta materia teñen dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria. O calendario de exames aprobado oficialmente pola Xunta do Centro da EIAE atópase publicado na seguinte páxina webhttp://aero.uvigo.es/gl/docencia/exames.

PARTE I da materia (Electrónica):

1ª oportunidade de avaliación, modo de avaliación continuo: as competencias adquiridas relativas á parte I avaliaranse mediante un traballo (valorado entre 0 e 1 punto) e un exame escrito (valorado entre 0 e 4 puntos).

O traballo deberase facer ao longo das semanas que se impartan as clases de Electrónica, no tempo destinado a actividades non presenciais. Será un traballo autónomo. O tema do traballo publicarase en Moovi, ao comezar o curso. O traballo deberá entregarse, escrito a man, antes de que finalicen as clases da parte I da materia. O exame constará de diversas cuestións e problemas sobre os temas do 1 ao 4 indicados no apartado Contidos desta materia e farase ao finalizar as clases de Electrónica.

Cualificación: no caso de obter unha nota igual ou superior a 2 puntos no exame (valorado entre 0 e 4 puntos), a nota correspondente á Parte I desta materia será igual á nota que se obteña no exame (valorado entre 0 e 4 puntos) máis a nota que se obteña polo traballo (valorado entre 0 e 1 punto). No caso de que a nota que se obteña no exame (valorado entre 0 e 4 puntos) sexa inferior a 2 puntos, a nota correspondente a Parte I desta materia será igual á nota que se obteña no exame (valorado entre 0 e 4 puntos).

1ª oportunidade de avaliación, modo de avaliación global: as competencias adquiridas relativas á parte I avaliaranse mediante un exame escrito (valorado entre 0 e 5 puntos). Dito exame constará de diversas cuestións e problemas sobre os temas do 1 ao 4 indicados no apartado Contidos desta materia e farase ao finalizar o cuadrimestre, na data indicada no calendario oficial de exames.

Cualificación: a nota correspondente a Parte I será igual á nota que se obteña no exame (valorado entre 0 e 5 puntos).

2ª oportunidade de avaliación e fin de carreira, modos de avaliación continuo e global: as competencias adquiridas relativas á parte I da materia avaliaranse mediante un exame escrito (valorado entre 0 e 5 puntos). Dito exame constará de diversas cuestións e problemas sobre os temas do 1 ao 4 indicados no apartado Contidos desta materia e farase na data indicada no calendario oficial de exames.

Cualificación: a nota correspondente a Parte I será igual á nota que se obteña no exame (valorado entre 0 e 5 puntos).

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PARTE II da materia, AUTOMÁTICA

AUTOMÁTICA: CRITERIOS DE AVALIACIÓN CONTINUA NA 1ª OPORTUNIDADE.

A avaliación continua de AUTOMATICA na 1ª oportunidade consta de:

- Unha proba de problemas e/ou exercicios sobre os contidos/competencias/resultados de aprendizaxe dos GRUPOS GRANDES/TEORIA. Esta proba es obrigatoria, representa un 35% da nota final e require un mínimo de 5 sobre 10. Esta proba realizarase o mesmo día que a proba global.
- Unha proba sobre os contidos/competencias/resultados de aprendizaxe das clases de GRUPOS REDUCIDOS/LABORATORIO. Esta proba es obrigatoria, representa un 10% da nota final e require un mínimo de 5 sobre 10. Esta proba realizarase na última clase de laboratorio do período formativo.
- Unha entrega dun informe de prácticas para avaliar a asistencia e participación activa nas clases teóricas e prácticas e nas titorías. Esta entrega no es obrigatoria e representa un 5% da nota final.

No caso de non superar o mínimo nalgunha das probas, a cualificación desta parte será dita suma, limitada a un máximo de 2.45 puntos sobre 5.

AUTOMATICA: CRITERIOS DE AVALIACIÓN GLOBAL EN LA 1ª OPORTUNIDADES, 2ª OPORTUNIDADE Y FIN DE CARREIRA.

A avaliación na 1ª oportunidade, 2ª oportunidade e fin de carreira consta de:

- Unha proba de problemas e/ou exercicios sobre os contidos/competencias/resultados de aprendizaxe dos GRUPOS GRANDES/TEORIA. Esta proba es obrigatoria, representa un 37.5% da nota final e require un mínimo de 5 sobre 10.
- Unha proba sobre os contidos/competencias/resultados de aprendizaxe das clases de GRUPOS REDUCIDOS/LABORATORIO. Esta proba es obrigatoria, representa un 12.5% da nota final e require un mínimo de 5 sobre 10.

No caso de non superar o mínimo nalgunha das das probas, a cualificación desta parte será dita suma, limitada a un máximo de 2.45 puntos sobre 5.

A avaliación na 2ª oportunidade e fin de carreira é sempre global.

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PROCESO DE CUALIFICACIÓN DE ACTAS

Independentemente da convocatoria, se un alumno suspende un exame ou obtén unha cualificación inferior á nota mínima para aprobar, se a puntuación total é superior a 5, a cualificación final na acta será de 4.0 ou suspenso.

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

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Notas para a parte de Electrónica:

_Non se corrixirá ningún exame de Electrónica ao que lle falte algunha das follas do enunciado ou ben algunha das follas que se facilitan para responder as preguntas do exame. Nun exame non se corrixirá ningunha resposta escrita a lapis ou cun bolígrafo de cor vermella ou de cor verde.

_ Á hora de representar símbolos de compoñentes electrónicos ou de circuítos integrados só se poden utilizar os símbolos explicados nas clases. No caso de electrónica dixital só se pode utilizar a simboloxía normalizada ANSI/IEEE Std. 991-1986. De non facelo así, non se puntuará o correspondente exercicio. Á hora de debuxar un diagrama de estados que describa o comportamento dun sistema secuencial ou ben se utiliza un modelo de tipo Moore ou ben se utiliza un modelo de tipo Mealy. En ningún caso se admitirá como válido outro tipo de modelo (ou representación).

_ Non se pode fotografar o enunciado dos exames de Electrónica. Durante os exames non se poden utilizar nin ter á vista libros, apuntamentos, calculadora, teléfono móbil, tablet, etc. No caso de que unha persoa non cumpra esta norma non se lle corrixirá devandito exame e poñeráselle un cero como notada parte I da materia. Durante a revisión dun exame non se

pode ter á vista un teléfono móbil ou tablet. De acordo co dereito fundamental á propia imaxe recoñecido no art.18.1 da Constitución española prohíbese gravar (audio e/ou vídeo) as clases teóricas e as titorías. Prohíbese fotografar o que escriba o profesor no encerado durante as clases. No caso de detectar a unha persoa copiando nun exame, a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

J. R. Cogdell, **Fundamentos de Electrónica**, 9789684444706, Prentice Hall, 2000

Albert Malvino, David Bates, **Principios de Electrónica**, 9788448156190, 7, McGraw-Hill Interamericana de España S.L., 2007

John F. Wakerly, **Digital Design: Principles and Practices**, 9780136139874, Pearson, 2010

T. L. Floyd, **Fundamentos de sistemas digitales**, 9788490353004, Prentice Hall, 2016

James M. Fiore, **Operational Amplifiers & Linear Integrated Circuits: Theory and Application**, 9781796856897, Paraninfo, 2016

Daniel W. Hart, **Power Electronics**, 9780073380674, McGraw Hill, 2010

Louis Nashelsky Robert L. Boylestad, **Electronic Devices and Circuit Theory**, 9780132622264, Pearson, 2012

KATSUHIKO OGATA, **INGENIERIA DE CONTROL MODERNA**, 9788483226605, 5, PRENTICE-HALL, 2010

Nise, Norman S., **Control Systems Engineering**, 9780470547564, 6, John Wiley & Sons Ltd, 2010

Ashish Tewari, **Modern Control Design With MATLAB and SIMULINK**, 9780471496793, Wiley, 2002

Complementary Bibliography

Allan Hambley, **Electrónica**, 9788420529998, PEARSON EDUCACION, 2001

V. Nelson y otros, **Análisis y diseño de circuitos lógicos digitales**, 9789688807064, Prentice Hall, 2003

J. E. García y otros, **Circuitos y sistemas digitales.**, 9788473601252, Tebar Flores, 1992

Charles H. Roth, **Fundamentos de diseño lógico**, 9788497322867, 5, Paraninfo, 2004

Robert F. Coughlin, Frederick F. Driscoll, **Amplificadores operacionales y circuitos integrados lineales**, 9780130149916, Prentice Hall, 2000

Miguel A. Pérez García y otros, **Instrumentación electrónica**, 9788428337021, Thomson, 2014

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Roy Langton, **Stability and Control of Aircraft Systems: Introduction to Classical Feedback Control**, 9780470018910, John Wiley & Sons, 2006

Brian L. Stevens, Frank L. Lewis, Eric N. Johnson, **Aircraft Control and Simulation: Dynamics, Controls Design, and Autonomous Systems,**, 9781118870983, 3, Wiley-Blackwell, 2016

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	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.			

Training and Learning Results	
Code	
B1	Capability 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.
B7	Capability to analyze and assess the social and environmental impact of technical solutions.
C14	Understand the air transport system and the coordination with other transport modes.
C19	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.
C21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.
D1	Capability of analysis, organization and planning.
D2	Leadership, initiative and entrepreneurship
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results		
Knowledge of the structure and the elements that conform the current system of world-wide transport.		C14	D1 D5 D8
Understanding of the legal characteristics of the aerial transport and knowledge of this transport mode law	B1 B7	C14 C21	D1 D2 D3 D4 D8 D13
Knowledge of the different elements that integrate the system of transports: aerial companies, manufacturing, airports, aerial navigation suppliers	B1 B7	C14 C19	D1 D2 D4 D6 D8 D13

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	B1 B7	C14 C19 C21	D1 D2 D3 D4 D6 D8 D13
Knowledge of the different systems and subsystems onboarded in aerospace vehicles	B1 B7	C14 C19 C21	D1 D3 D4 D8 D13
Knowledge of the way in which the aerial way inserts in the system of transport and the distinct forms of cooperation and intermodal competition	B1	C14	

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	Introduction to flight systems Engine and fuel Systems Hydraulic System Eectrical System Pneumatic System Air conditioning Systems Navigation Systems Positioning Systems

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	68.5	96.5
Laboratory practical	22	29	51
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
Lecturing	The teacherwill expose the theoretical bases of the subject. The students will have basic reference texts
Laboratory practical	IT and laboratory solutions will be used to solve problems and exercises and apply the knowledge achieved.

Personalized assistance

Methodologies	Description
Lecturing	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	Training and Learning Results		
Objective questions exam	Test or question's evaluation exam.	40	B1 B7	C14 C19 C21	D3 D8

Other comments on the Evaluation

By default, the evaluation is assumed to be continuous. The student has the right to opt for the global evaluation according to the procedure and deadline established by the center for each call.

- Continuous evaluation:

- At the first opportunity:

- There will be a partial, liberating exam during the course, with part of the contents of the subject. To pass said written test and release that part of the subject, it is necessary to obtain a grade of 5 out of 10; this part can be released if the grade exceeds 4 out of 10, and if the rest of the parts compensate the grade to exceed a final grade of 5 out of 10. The weight of this test in the final grade for this case is 30% .

- A final exam will be held on the official date indicated by the center. Said written test will consist of three parts: a first for students who have passed the partial exam, and with a weight of 40% in the final grade; a second part, for students who have not passed the partial exam (with its weight, of 30%); a third, for those students who haven't achieved a 4/10 in any of the practical deliverables.

- Two qualifying internships will be delivered within the regular internship schedule, with a weight of 30% in the final grade: a first, with a partial weight of 40%, and a second, with a partial weight of 60%.

- The minimum grade to be achieved in any test will be 4 out of 10 to be able to balance the exam and practicals. To pass the subject, you must pass a weighted grade (written exams, possible work, internships), of 5 out of 10, and it is also required to have attended at least 90% of the internships. The written tests may consist of test-type questions and/or short questions and/or development questions.

- In the second opportunity:

- A complete exam that covers every angle of the subject will be issued.

- To pass the subject you must pass 5 out of 10. The exam may consist of test-type questions and/or short questions and/or development questions.

- Global evaluation / End of career:

- A final exam will be held on the official date indicated by the center, which will cover all aspects of the subject.

- To pass the subject you must pass 5 out of 10. The exam may consist of test-type questions and/or short questions and/or development questions.

In case of detection of plagiarism in any qualification item, the qualification in said item will be 0 and the fact will be communicated to the Center's management for the appropriate effect.

Sources of information

Basic Bibliography

Ian Moir & Allan Seabridge, **Aircraft systems**, Wiley,

Mike Tooley, **Aircraft digital electronic and computer systems**, Routledge,

Luis Utrilla Navarro, **Descubrir el transporte aéreo**, Aena Aeropuertos SA,

Arturo Benito, **Descubrir el transporte aéreo y el medio ambiente**, AENA,

Complementary Bibliography

L. Tapia, **Derecho aeronáutico**, Bosch,

A. Benito, **Descubrir las líneas aéreas**, AENA,

Recommendations

Subjects that are recommended to be taken simultaneously

Electronics and automation/O07G410V01403

Subjects that it is recommended to have taken before

Aerospace technology/O07G410V01205

IDENTIFYING DATA				
Resistencia de materiais e elasticidade				
Subject	Resistencia de materiais e elasticidade			
Code	O07G410V01405			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Conde Carnero, Borja			
Lecturers	Conde Carnero, Borja			
E-mail	bconde@uvigo.es			
Web	http://aero.uvigo.es			
General description	Principios básicos da elasticidade e a resistencia de materiais. Aplicacións ao campo da enxeñería aeroespacial.			

Resultados de Formación e Aprendizaxe	
Code	
B1	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.
B2	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.
B4	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.
C7	Comprender o comportamento das estruturas ante as solicitacións en condicións de servizo e situacións límite.
C15	Coñecemento adecuado e aplicado á Enxeñaría de: Os principios da mecánica do medio continuo e as técnicas de cálculo da súa resposta.
C18	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.
C19	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.
D1	Capacidade de análise, organización e planificación
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Comprensión, análise e cálculo de problemas sinxelos de elementos estruturais baixo comportamento lineal	B1	C7 C15 C18 C19	D1 D4 D5 D8
Comprensión da teoría básica e da solución de algúns problemas fundamentais en elasticidade lineal de sólidos	B1 B4	C7 C15 C18 C19	D1 D3 D4 D5 D8

Coñecemento, comprensión e aplicación dos métodos de cálculo	B1 B2 B4	C7 C15 C18 C19	D1 D3 D4 D5 D8
Aplicación, análise e síntese de estruturas	B1 B2 B4	C7 C15 C18	D1 D3 D4 D5 D6 D8

Contidos	
Topic	
1.- Introdución ao estudo da elasticidade e a resistencia de materiais.	1.1.- Obxecto da elasticidade e a resistencia de materiais. 1.2.- Concepto de sólido. 1.3.- Definición de prisma mecánico. 1.4.- Equilibrio estático e equilibrio elástico. 1.5.- Esforzos sobre un prisma mecánico.
2.- Forzas internas.	2.1.- Introdución. 2.2.- Forzas internas nunha viga. 2.3.- Relacións entre solicitacións e forzas externas. 2.4.- Convenio de signos. 2.5.- Equilibrio dunha rebanada. 2.6.- Diagramas de solicitacións.
3.- Tracción-compresión.	3.1.- Introdución. 3.2.- Tensións. 3.3.- Deformacións. 3.4.- Estruturas hiperestáticas.
4.- Flexión	4.1.- Flexión pura. 4.2.- Flexión simple. 4.3.- Flexión composta. 4.4.- Flexión deformacións. Análise. 4.5.- Ecuación diferencial da elástica. 4.6.- Teoremas de Mohr. 4.7.- Método da viga conxugada. 4.8.- Flexión hiperestaticidade.
5.- Torsión	5.1.- Sección circular.
6.- Métodos enerxéticos de cálculo.	6.1.- Introdución . 6.2.- Enerxía de deformación dunha viga. 6.3.- Teorema de reciprocidade. 6.4.- Teorema de Castigliano.
7.- Análise de tensións.	7.1.- Concepto de tensión. 7.2.- Compoñentes do vector tensión. 7.3.- Equilibrio do paralelepípedo elemental. 7.4.- Tensor de tensións. 7.5.- Tensións e direccións principais. 7.6.- Tensores esférico e desviador. 7.7.- Circulos de Mohr.
8.- Análise de deformacións.	8.1.- Deformación do paralelepípedo elemental. 8.2.- Concepto de deformación. 8.3.- Tensor de deformacións. 8.4.- Deformacións e direccións principais. 8.5.- Variacións de volume, área e lonxitude. 8.6.- Círculos de Mohr.
9.- Tensións - deformacións e outros temas.	9.1.- Comportamento mecánico dos materiais. 9.2.- Modelos de comportamento dos materiais. 9.3.- O modelo de comportamento elástico-lineal. 9.4.- Elasticidade bidimensional. 9.5.- Deformacións e tensións: efecto da temperatura. 9.6.- O problema elástico. 9.7.- Enerxía de deformación. 9.8.- Criterios de plastificación e rotura. 9.9.- Recipientes de parede delgada.

10.- Análise matricial de estruturas de barras.	10.1.- Introdución ao método matricial dos desprazamentos ou de rixidez. 10.2.- Matriz de rixidez dunha barra. Estruturas articuladas e reticuladas. 10.3.- Ensamblaxe da matriz de rixidez global da estrutura. 10.4.- Aplicación das condicións de contorno. 10.5.- Resposta da estrutura: desprazamentos, reaccións e esforzos. 10.6.- Casos particulares de cálculo.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	60	90
Prácticas de laboratorio	16	37.5	53.5
Exame de preguntas de desenvolvemento	2.5	0	2.5
Exame de preguntas obxectivas	2	0	2
Resolución de problemas e/ou exercicios	2	0	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 na aula da teoría básica da materia.
Prácticas de laboratorio	Resolución de problemas relacionados cos contidos teóricos.

Atención personalizada

Methodologies	Description
Lección maxistral	O profesor atenderá persoalmente as dúbidas e consultas do estudantado. 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.
Prácticas de laboratorio	Nas prácticas tentarase na medida do posible atender persoalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas.

Avaliación

	Description	Qualification	Training and Learning Results
Prácticas de laboratorio	Asistencia e participación activa en todas as clases prácticas do cuatrimestre, así como a entrega en tempo e forma de toda a documentación solicitada. Puntuarase co valor indicado, sempre que no exame final se alcance polo menos o 50% da cualificación posible. Estas actividades non son recuperables.	10	B1 C7 D1 B2 C15 D3 B4 C18 D5 C19 D6 D8
Exame de preguntas de desenvolvemento	Exame escrito de todos os contidos da materia nas datas establecidas polo centro. No caso de non alcanzar o limiar mínimo (50%), a cualificación final será a correspondente á obtida nesta proba.	40	B1 C7 D1 B2 C15 D4 B4 C18 D5 C19 D8
Exame de preguntas obxectivas	Probas que avalían coñecementos que inclúen preguntas pechadas con diferentes alternativas de resposta (verdadeiro/falso, opción múltiple, emparellamento de ítems...). O estudantado selecciona unha resposta entre un número limitado de posibilidades. Puntuarase co valor indicado, sempre que no exame final se alcance polo menos o 50% da cualificación posible. Esta proba intermedia non é recuperable.	25	C15 D4 C19 D8
Resolución de problemas e/ou exercicios	Proba na que o estudantado deberá resolver unha serie de problemas e/ou exercicios nun tempo/condicións que estableza o equipo docente. Puntuarase co valor indicado, sempre que no exame final se alcance polo menos o 50% da cualificación posible. Esta proba intermedia non é recuperable.	25	C7 D1 C15 D4 C18 D5 C19 D8

Other comments on the Evaluation

A avaliación será de tipo continuo, a menos que as/os estudantes renuncien a ela a través do procedemento oficial pertinente. En tal caso, a avaliación realizarase exclusivamente mediante un exame escrito, abarcando o 100% da cualificación. Este enfoque específico de avaliación denominarase avaliación global. A cualificación obtida para as prácticas de laboratorio (10%), conservarase para a avaliación en segunda oportunidade e convocatoria fin de carreira. Nas devanditas convocatorias o 90% restante da cualificación obterase mediante un exame escrito, nas datas establecidas polo centro, acerca dos contidos teóricos e/o prácticos. As prácticas de laboratorio puntuaranse co valor indicado, sempre que no devandito exame se alcance polo menos o 50% da cualificación posible.

Estudantes que renuncian oficialmente á avaliación continua

Neste caso, a nota obtida no exame final representará o 100% da calificación.

O/a estudante ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

Prácticas de laboratorio

A parte presencial correspondente a cada práctica realízase nunha data concreta, polo que non é posible recuperar as ausencias. Escusaranse aquelas prácticas nas que o/a estudante presente un xustificante oficial (médico, xulgado,...) debido a razóns inevitables de forza maior.

Probas de avaliación

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. A duración máxima dun exame será de 3 horas se non hai pausa ou de 5 horas se hai unha pausa intermedia (sendo 3 horas o máximo para cada parte).

Non se permitirá o uso de ningún dispositivo electrónico durante as probas de avaliación a menos que este estea expresamente autorizado. O feito de introducir un dispositivo electrónico non autorizado na aula do exame será considerado motivo de non superación da materia no curso académico actual e a nota global será de suspenso (0,0).

Compromiso ético

En caso de detección de copia en calquera das probas (probas curtas, exames parciais, ou exame final) a cualificación final será de SUSPENSO (0.0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

Observación

No caso de discrepancia nas versións entre idiomas desta guía, prevalece a versión en castelán.

Bibliografía. Fontes de información
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
Luis Ortiz Berrocal, **Resistencia de materiales**, McGraw-Hill, 2007
Manuel Vazquez, **El método de los elementos finitos**, Noela, 2011
Complementary Bibliography

Recomendacións
Subjects that continue the syllabus
Mecánica de sólidos e estruturas aeronáuticas/O07G410V01921

Subjects that it is recommended to have taken before
Expresión gráfica: Expresión gráfica/O07G410V01105
Física: Física I/O07G410V01103
Física: Física II/O07G410V01202
Matemáticas: Cálculo I/O07G410V01101
Matemáticas: Cálculo II/O07G410V01201

IDENTIFYING DATA				
Fabricación aeroespacial				
Subject	Fabricación aeroespacial			
Code	O07G410V01501			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	Carou Porto, Diego			
Lecturers	Carou Porto, Diego			
E-mail	diecapor@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia introduce os fundamentos dos procesos de fabricación (deseño, tecnoloxías, planificación, simulación e control de calidade) no ámbito da fabricación aeroespacial.			

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B1	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.
B2	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.
C11	Comprender as prestacións tecnolóxicas, as técnicas de optimización dos materiais e a modificación das súas propiedades mediante tratamentos.
C12	Comprender os procesos de fabricación.
C19	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.
C25	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.
C26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.
C32	Coñecemento adecuado e aplicado á Enxeñaría de: Os métodos de cálculo e de desenvolvemento dos materiais e sistemas da defensa; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación numérica dos procesos físico-matemáticos máis significativos; as técnicas de inspección, de control de calidade e de detección de fallos; os métodos e técnicas de reparación máis adecuados.
D2	Liderado, iniciativa e espírito emprendedor
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
D13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Coñecemento dos principios xerais sobre deseño xeométrico, funcional e os específicos dos elementos e instalacións propias das especialidades.	A2 A3 A5	B1 B2	C12	D2 D3 D4 D8 D11 D13
Interpretación, confección e xestión de documentos técnicos, para o deseño conceptual, preliminar e detalle de modelos físicos e sistemas	A2 A3 A5	B1 B2	C11 C12 C19 C25 C26 C32	D4 D8
Criterios de calidade e análise destes deseños. O alumno ou alumna coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación.	A2 A3 A5	B1 B2	C12	D2 D3 D4 D6 D8 D11 D13
O alumno ou a alumna coñece toda a información necesaria para levar a cabo un proceso de produción.	A2 A3 A5	B1 B2	C12	D2 D3 D4 D8 D11 D13
O alumno ou a alumna é capaz de realizar un informe que permita a execución exitosa dun proceso de produción.	A2 A3 A5	B1 B2	C12	D2 D3 D4 D8 D11 D13

Contidos	
Topic	
Bloque I	1. Integración do deseño e fabricación 2. Conformado por deformación plástica 3. Conformado por mecanizado 4. Conformado de plásticos 5. Conformado por moldeo 6. Pulvimetalurxia 7. Fabricación aditiva 8. Conformado de materiais compostos 9. Técnicas de unión e ensamblaje 10. Metroloxía
Bloque II	Simulación de procesos de fabricación

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	10	20	30
Lección maxistral	7	16	23
Resolución de problemas	12.5	21.5	34
Aprendizaxe colaborativa	1	2	3
Prácticas con apoio das TIC	15	35	50
Prácticas de laboratorio	3	3	6
Saídas de estudo	1.5	0	1.5
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
Lección maxistral	Exposición por parte do profesor dos contidos fundamentais da materia.
Lección maxistral	Exposición por parte do profesor dos contidos fundamentais da materia.
Resolución de problemas	Presentación e resolución por parte do profesor de problemas relativos aos procesos de fabricación estudados de maneira teórica coa participación activa das/os estudantes.

Aprendizaxe colaborativa	O profesor exporá temas de estudo que as/os estudantes traballarán de maneira autónoma para elaborar contidos adicionais de maneira colaborativa.
Prácticas con apoio das TIC	Introdución ao emprego de software de simulación de procesos de fabricación por parte do profesor. Coas instrucións recibidas e traballo autónomo, as/os estudantes poderán resolver problemas específicos que permitan mellorar o seu coñecemento sobre os procesos estudados.
Prácticas de laboratorio	Introdución ao traballo con equipos de fabricación no laboratorio.
Saídas de estudo	Visitas a empresas, centros tecnolóxicos e outras entidades de interese.

Atención personalizada

Methodologies	Description
Lección maxistral	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Resolución de problemas	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Prácticas con apoio das TIC	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Aprendizaxe colaborativa	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Prácticas de laboratorio	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Saídas de estudo	Prestarase atención ao estudantado no horario lectivo como no de titorías.
Lección maxistral	Prestarase atención ao estudantado no horario lectivo como no de titorías.

Avaliación

	Description	Qualification	Training and Learning Results		
Lección maxistral	Proba escrita 1	40	A2 A5	C12	D4 D8
Lección maxistral	Proba escrita 2	25	A2 A5	C12	D4 D8
Resolución de problemas	Entrega de problemas propostos resoltos	15	A2 A5	C12	D2 D3 D4 D8
Aprendizaxe colaborativa	Participación en actividades propostas	5	A2 A3 A5	C12	D2 D3 D4 D6 D8 D13
Prácticas con apoio das TIC	Entrega de memorias de prácticas	15	A2 A5	C12	D2 D3 D4 D8 D11

Other comments on the Evaluation

O modelo de avaliación é avaliación continua.

O/A estudante ten dereito a optar pola avaliación global, **EXCLUSIVAMENTE**, segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

O exame global consistirá nun exame escrito en data oficial que cubra todos os aspectos avaliados en avaliación continua.

PRIMEIRA OPORTUNIDADE:

A materia avalíase en base a tres parámetros:

- Exames teórico-prácticos (nota máxima 8 puntos). Consistirán en dúas probas. A primeira durante o desenvolvemento do curso e a segunda na data oficial de exame. Nestas probas avalíanse os coñecementos teóricos da materia, problemas e prácticas. O primeiro exame valórase en 4 puntos e o segundo en 4 puntos. Este segundo exame ten unha parte de resolución de problemas valorada en 1,5 puntos.
- Aprendizaxe colaborativo (nota máxima 0,5 puntos). Deberase participar nas actividades propostas durante o curso. Este apartado será avaliado en grupo.
- Prácticas (nota máxima 1,5 puntos). Avaliarase a entrega das memorias de prácticas durante o curso nos prazos establecidos.

Aprobarán a materia aqueles alumnos que consigan unha nota igual ou superior a 5 puntos. Non se fará media no caso de que no conxunto dos exames teórico-prácticos a nota sexa inferior a 4,5; sendo a nota final de actas suspenso ata o máximo permitido. Non é posible recuperar ningunha proba a posteriori, salvo causa xustificada.

SEGUNDA OPORTUNIDADE:

O método de Avaliación é o mesmo que o descrito para a PRIMEIRA OPORTUNIDADE. Poderanse gardar traballos da primeira oportunidade con cualificación >5. En ningún caso gardarase a cualificación dos exames.

OUTRAS CONSIDERACIÓNS:

En caso de detección de plaxio en calquera das probas, a cualificación final será de SUSPENSO (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.As probas desenvolveranse durante o cuadrimestre. O exame teórico-práctico inicial desenvolverase en data a definir e indicada ás/os estudantes con antelación suficiente.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

A evaluación fin de carreira seguirá os mesmos criterios ca evaluación de 2ª oportunidade.

Bibliografía. Fontes de información

Basic Bibliography

Serope Kalpakjian, Steven Schmid, **Manufacturing Engineering and Technology**, 8, Pearson Education, 2020

Mikell P. Groover, **Fundamentos de manufactura moderna: materiales, procesos y sistemas**, 3, Prentice-Hall, 2007

Mikell P. Groover, **Principles of modern manufacturing**, 5, John Wiley & Sons, 2013

Complementary Bibliography

J.T. Black, Ronald A. Kohser, **DeGarmo□s Materials and Processes in Manufacturing**, 13, Wiley, 2019

A. Sartal, D. Carou, J.P. Davim, **Enabling Technologies for the Successful Deployment of Industry 4.0**, 1, CRC Press, 2020

Carou, D., Davim, J.P., **Notes for Manufacturing Instructors From Class to Workshop**, 1, Springer, 2024

Geoffrey Boothroyd; Peter Dewhurst; Winston A. Knight, **Product Design for Manufacture and Assembly**, 3, CRC Press, 2011

Recomendacións

Subjects that continue the syllabus

Tecnoloxías para conformado de materiais aeroespaciais/O07G410V01913

IDENTIFYING DATA				
Dirección e xestión de proxectos				
Subject	Dirección e xestión de proxectos			
Code	O07G410V01701			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Rey González, Guillermo David			
Lecturers	Orgeira Crespo, Pedro Rey González, Guillermo David			
E-mail	guillermo.rey@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia aborda os aspectos técnicos, económico-financieros, legais e de xestión dos proxectos de enxeñaría aeroespacial.			

Resultados de Formación e Aprendizaxe
Code

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Contidos	
Topic	
Tema 1. Xestión de Calidade. Xestión de Mercadotecnia.	1.1. Xestión de Calidade 1.2. Xestión de Mercadotecnia.
Tema 2. Dirección empresarial: función directiva. Xestión de recursos humanos e do coñecemento.	
Tema 3. Xestión económico-financeira da empresa.	
Tema 4. Tipo de proxectos de enxeñaría. Planificación, avaliación e control dun proxecto.	
Tema 5. Xestión do alcance, tempo, calidade, recursos humanos e comunicacións dun proxecto. Custo e risco.	
Tema 6. Indicadores obxectivos do resultado dun proxecto.	
Tema 7. Impacto ambiental de aeroportos, aerolíneas e instalacións aeronáuticas. Normativa	

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32	63	95
Aprendizaxe baseado en proxectos	10	16.5	26.5
Estudo de casos	8	18	26
Presentación	0.5	0	0.5
Exame de preguntas obxectivas	2	0	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/a dos contidos sobre a materia obxecto de estudo, bases teóricas e/ou directrices dun traballo, exercicio que o/a estudante ten que desenvolver.
Aprendizaxe baseado en proxectos	O/A estudante, de maneira individual ou en grupo, elabora un documento sobre a temática da materia ou prepara seminarios, investigacións, memorias, ensaios, resumos de lecturas, conferencias etc.
Estudo de casos	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedementais relacionadas coa materia obxecto de estudo. Desenvólvense en espazos especiais con equipamento especializado (Laboratorios, aulas informáticas, etc...)

Atención personalizada

Methodologies	Description
Lección maxistral	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades a realizar en grupo, ou simplemente para informar ao docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.
Aprendizaxe baseado en proxectos	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades a realizar en grupo, ou simplemente para informar ao docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.

Avaliación

	Description	Qualification	Training and Learning Results
Aprendizaxe baseado en proxectos	Realización dun proxecto relacionado co contido da materia	20	
Estudo de casos	Resolución de problemas e casos prácticos expostos nas sesións de prácticas	20	
Presentación	Presentación e defensa do traballo en grupo desenvolvido.	20	
Exame de preguntas obxectivas	Exame tipo test	40	

Other comments on the Evaluation

O calendario de probas de avaliación atópase publicado na páxina Web do centro.

Primeira oportunidade.

(1) Estudantes que seguen o curso por Avaliación Continua.

Para poder superar a materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, no exame final de avaliación continua de, como mínimo, un 4.0.

-Asistir a, como mínimo, o 90% das sesións de prácticas.

-Entregar a totalidade de memorias prácticas e traballos da materia obtendo, como mínimo, unha nota de 3 en cada un deles.

No caso de non cumprir ditas condicións a nota final será a resultante do mínimo da nota media ponderada de AC e de 4.9.

(2) Estudante que desexen ser avaliados mediante avaliación global.

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua. O estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

A nota obtida neste exame representará o 100% da nota final. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados en todas as sesións prácticas e traballos.

Segunda oportunidade e Fin de Carrera.

O estudantado que non superase a materia na primeira oportunidade poderá realizarán un exame que supoñerá o 100% da nota. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados

en todas as sesións prácticas e traballos.

En caso de detección de plaxio en calquera elemento de cualificación, a cualificación na devandita entrega será 0 e o feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

Philip Kotler, **Fundamentos De Marketing**, 978-6073238458, 13, ADDISON-WESLEY, 2017

Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, **Marketing 6.0**, 978-8410221093, LID, 2024

Imai Massaki, **Gemba Kaizen. Un enfoque hacia la mejora continua de la estrategia**, 978-8448193300, 2, Mcgraw-Hill, 2015

John H. Zenger, Joseph R. Folkman, **El Nuevo Lider Extraordinario - Convertir Buenos Directivos En Grandes Lideres: Convertir buenos directivos en grandes líderes**, 978-8418464027, Profit, 2022

Project Management Institute, **Guía de los Fundamentos Para la Dirección de Proyectos (guía del PMBOK)**, 978-1628256796, 7, Project Management Institute, 2021

Daniel Arias Aranda, Beatriz Minguela Rata, **Dirección de la producción y operaciones: Decisiones estratégicas**, 978-8436839005, Ediciones Pirámide, 2018

Montserrat Cabrerizo, **Gestión Económica y Financiera de la Empresa**, 978-8426724540, 2, Marcombo Formación, 2017

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Empresa: Administración da tecnoloxía e a empresa/O07G410V01204

IDENTIFYING DATA				
Navigational systems				
Subject	Navigational systems			
Code	O07G410V01901			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	González Jorge, Higinio			
Lecturers	Aldao Pensado, Enrique González Jorge, Higinio			
E-mail	higiniog@uvigo.gal			
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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Capability 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.
B6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
C19	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.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Understanding the need for aircraft navigation systems	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11
Understanding of the theoretical foundations and operation of aircraft navigation systems. Understanding of external agents that affect these systems.	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11
Understanding of the methods to ensure the proper working of these systems.	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11

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 trends 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	24	24	48
Practices through ICT	24	24	48
Mentored work	2	19.5	21.5
Objective questions exam	1.25	0	1.25
Objective questions exam	1.25	0	1.25
Report of practices, practicum and external practices	0	10	10
Project	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
Lecturing	Exhibition of the contents of the subject through audiovisual media.
Practices through ICT	Problem solving through software tools such as Matlab, QGIS and Mission Planner.
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. Tutorials with previous appointment. Attention by email.
Practices through ICT	Classroom attention. Tutorials with previous appointment. Attention by email.
Mentored work	Tutorials with previous appointment. Attention by email.

Assessment

	Description	Qualification	Training and Learning Results			
Objective questions exam	Partial exam I type test.	25	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11
Objective questions exam	Partial exam II type test.	25	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11
Report of practices, practicum and external practices	Each practicum will define a deliverable that the student must send to the professor before the indicated deadline.	30	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11
Project	The student must submit a final report with the work done. In addition, he/she must make an exposition of the work.	20	A2 A3 A5	B1 B6	C19	D3 D4 D6 D8 D11

Other comments on the Evaluation

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

The continuous assessment will be carried out during university class hours. For one of the tests to average with the rest, the student must obtain at least a score of 4.

The official exam dates are used for the student to take an exam-only assessment of the course if he/she does not follow the continuous assessment or fails it. This exam will consist of a test of 100 questions, its qualification will correspond to 100% of the course and will have a duration of 2 hours. This applies to the first opportunity, second opportunity and end-of-course evaluation.

The minimum grade to pass the course is a 5, which is obtained from the average of the grades of each test taken, provided that they exceed the minimum qualification (continuous evaluation), or from the 100-question multiple-choice test (global evaluation).

No marks for each of the parts will be kept between different exam sessions.

The calendar of evaluation tests officially approved by the Faculty is published on the web page:

http://aero.uvigo.es/es/docencia/examenes/

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
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				
Materials for the aerospace industry				
Subject	Materials for the aerospace industry			
Code	O07G410V01903			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Álvarez González, David			
Lecturers	Álvarez González, David Gomez Barreiro, Silvia			
E-mail	davidag@uvigo.es			
Web	http://dept05.webs.uvigo.es/			
General description	The aim of this subject is to offer to the students knowledges and tools for the selection of materials in the aerospace field. 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Capability 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.
C20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results			
New	A2 A3 A5	B1	C20	D3 D4 D5 D6 D8 D11 D13
New	A2 A3 A5	B1	C20	D3 D4 D5 D6 D8 D11 D13

New	A2 A3 A5	B1	C20	D3 D4 D5 D6 D8 D11 D13

Contents	
Topic	
Subject 1. Selection of Materials	Criteria employed for the selection of materials in function of his application. Employment of Indexes of Material and Indexes of Performance. Ashby diagrams. Management of databases of material properties.
Subject 2. Aerospace Alloys.	Steels. Light alloys. Titanium and Superalloys Manufacture and optimisation of material properties. Termo-mechanical Treatments. Mechanical and thermal properties of alloys.
Subject 3. Composite materials.	Classification: polymeric , metallic or ceramic matrix. Mechanical and thermal properties of the materials. Estimation of properties of compound materials.
Subject 4. Behaviour and Failure of aerospace materials	Friction and wear. Enbrittlement. Fracture. Corrosion and degradation. Fatigue. Creep. Analysis of failures. Diagnostic and inspection of failures.
Subject 5. Mechanical and adhesive joints.	Mechanical joints. Welding. Adhesive joints. Classification and properties.
Subject 6. Quality control and Testing.	Quality control of raw materials. Techniques of thermal analysis. Mechanical testing. Non destructive testing (NDT).

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	24	52.5	76.5
Laboratory practical	4	7	11
Autonomous problem solving	4	7.5	11.5
Studies excursion	6	2	8
Practices through ICT	10	17	27
Mentored work	2	10	12
Objective 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	Oral presentation of the contents of the course.
Laboratory practical	Activities for the practical application of the knowledges purchased.
Autonomous problem solving	Resolution of problems and exercises related with the matter.
Studies excursion	Visits in groups to companies of the aeronautical sector.
Practices through ICT	Practical exercises of selection of materials with software CES-EduPack.
Mentored work	Oral presentation of mentored related with the employment of materials in the aerospace industry.

Personalized assistance	
Methodologies	**Description**
Laboratory practical	Time in which the professor helps to the student to resolve and make the activities proposed in the lab.
Autonomous problem solving	Orientation that the teacher loans to the students for the correct resolution of the problems .
Lecturing	Attention that the professor loans of individual way to the students to resolve the doubts and difficulties that they find on the understanding of the contents of the matter.

Practices through ICT	Time devoted to the resolution of doubts, and to the practical application of the available computer tools for the selection of materials.
Mentored work	It will facilitate to the student orientation and documentation for the preparation of the mentored works.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Reports of the lab work that the student will have to deliver (individual or in groups).	15	A2 A3 A5	B1	C20	D4 D5 D6 D8 D11 D13
Practices through ICT	Reports of the lab work that the student will have to deliver (individual or in groups).	15				
Objective questions exam	Individual written proof in which the student/to will have to answer to relative questions to the matter presented in the classroom.	40	A2 A3 A5	B1	C20	D3 D4 D5 D8 D11 D13
Presentation	Oral presentation by groups of a subject proposed during the development of the matter.	30	A2 A3 A5	B1	C20	D3 D4 D5 D6 D8 D11

Other comments on the Evaluation

The data corresponding to schedules, classrooms and exam dates can be consulted in an updated way on the centre's website:http://aero.uvigo.es/gl/docencia/exames

To pass the course in the first call, it will be necessary to achieve at least 40% of the maximum mark in each of the evaluated tests. If said 40% is not reached in any test, the final grade will be limited by 4.9. The qualification of the practical part will be maintained for the second call.

The student has the right to opt for the global evaluation according to the procedure and the term established by the center for each call. In the case of opting for the global evaluation, the subject will be evaluated with an exam that will include contents developed in the theoretical classes and the contents and problems developed during the practices. The same methodology will be applied for the evaluation in the second call and in the end of program call.

The use of any type of electronic device during the evaluation tests is prohibited, unless expressly authorized. The fact of introducing any unauthorized device in the classroom during the evaluation test will be considered a reason for not passing the subject. In this case, the student will obtain a grade of 0 (failed).

Evaluation for non-assistants: the qualification course will be that of a final exam to evaluate all the competences assigned to the subject.

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

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

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

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

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

Prasad, N.E., **Aeroespace materials and Materials tecnologies**, 1, Springer, 2017

Recommendations

Subjects that it is recommended to have taken before

Materials science and technology/O07G410V01304
Resistance of materials and resilience/O07G410V01405
Aerospace manufacturing/O07G410V01501

IDENTIFYING DATA				
Systems in real time				
Subject	Systems in real time			
Code	O07G410V01904			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	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	Real time systems in aerospace are introduced, explaining the requeriments of real time systems for aerospace vehicles. 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
C31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results		
Knowledge, understanding and application of the requests of the systems in real time to the basic systems of control of flight		C24	
Knowledge, understanding and application of the requests of the systems in real time to the basic systems of control of flight	A2 A3 A5	C24 C31	D11

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	30	59	89
Laboratory practical	13	16	29
Mentored work	7	22.5	29.5

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
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

Personalized assistance

Methodologies	Description
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	Training and Learning Results		
Laboratory practical	Reports on practical classes, as required	20	A2 A3 A5	C24 C31	D11
Mentored work	Presentation and report on the mentored work	40	A2 A3 A5	C24 C31	D11
Objective questions exam	Examen	40	A2 A3 A5	C24 C31	D11

Other comments on the Evaluation

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

First call:

- For the evaluation of the exam to be carried out, the student must have attended all the practices and made all the required deliveries of laboratory practices and supervised work (in the case it exists), on the dates indicated; In addition, it will be necessary that the average grade of the deliveries exceeds 4 out of 10.

- The minimum mark to be reached in the final continuous assessment exam will be 4 out of 10 to be able to weigh the exam, supervised work (in case of taking the latter), and practicals. I

- To pass the subject, you must pass a weighted grade (exam, work, practice) of 5 out of 10. The exam may consist of test questions and / or short questions and / or questions developmental.

Second call:

- Students who have not passed the subject in the first callwill take an exam-only assesment that will have the same format and the same requirements as the first oportunity. In order to pass the subject, the weighted minimum mark between exam and practice reports will be 5 out of 10, and it is also necessary that this test exceed 4 out of 10.

Overall assestment:

- Students who opt for the global evaluation, or have not met the requirements for continuous evaluation, will take a written exam that will cover all aspects of the subject, and will require a 5/10 to pass.

As a student at the University of Vigo, the University Student Statute, 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 assessment tests, in the work carried out or in official university documents . Therefore, the student is expected to have 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 on 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

Subjects that it is recommended to have taken before

Computer science/O07G410V01104

Electronics and automation/O07G410V01403

Air transport and airborne systems/O07G410V01404

IDENTIFYING DATA				
Meteoroloxía				
Subject	Meteoroloxía			
Code	O07G410V01905			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	#EnglishFriendly Castelán Galego			
Department	Física aplicada			
Coordinator	de la Torre Ramos, Laura			
Lecturers	Añel Cabanelas, Juan Antonio de la Torre Ramos, Laura Pérez Souto, Celia			
E-mail	ltr@uvigo.es			
Web	http://aero.uvigo.es			
General description	Introdución á meteoroloxía e a súa influencia nas operacións aeronáuticas e do espazo. Materia do programa English *Friendly: Os/as estudantes internacionais poderán solicitar ao profesorado: a) materiais e referencias bibliográficas para o seguimento da materia en inglés, b) atender as *tutorías en inglés, c) probas e avaliacións en inglés.			

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
C10	Comprender como as forzas aerodinámicas determinan a dinámica do voo e o papel das distintas variables involucradas no fenómeno do voo.
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecemento dos efectos meteorolóxicos e as súas causas	A2 A3 A5		D11
Comprensión da utilización e impacto da meteoroloxía na operación da aeronave.	A2 A3 A5	C10	D11
Comprensión dos fundamentos teóricos dos sistemas e instrumentación meteorolóxica	A2 A3 A5		D11

Contidos	
Topic	
Atmosfera e meteoroloxía	A atmosfera Composición e estrutura Meteoros Información meteorolóxica aeronáutica
Termodinámica e estabilidade	Condensación isobárica e adiabática Sondeos Diagramas aerolóxicos Parámetros de temperatura, humidade e niveles Estabilidade Índices de inestabilidade

Vento	Introdución Ecuación do movemento Fluxo horizontal Vento térmico Estrutura do vento na PBL Efectos da orografía
*Microfísica de nubes	Conceptos previos Nubes cálidas Nubes frías Xeada
*Convección	Conceptos previos Tormentas convectivas Dinámica de supercélulas Electricidade Sistemas convectivos a mesoescala (SCM) Perigos para a navegación aérea
Ciclóns tropicais e extratropicais	Ciclóns tropicais Transición Ciclóns extratropicais
Visibilidade e partículas	Introdución Factores que afectan á visibilidade Néboas e estratos Tormentas de po e area Cinzas volcánicas
Predición meteorolóxica	Predición e prazos Modelos numéricos de predición do tempo

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	24	10	34
Resolución de problemas de forma autónoma	10	35	45
Prácticas con apoio das TIC	15	0	15
Presentación	1	19	20
Exame de preguntas obxectivas	2.5	33.5	36

*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	Clases teóricas na aula con todo o grupo. Exposición dos principais contidos teóricos e prácticos da materia con axuda das TICs e pizarra. A parte non presencial consistirá en tarefas fóra da aula que axuden a fixar ou ampliar coñecementos.
Resolución de problemas de forma autónoma	Tras as explicacións do profesor, o alumnado deberá poder realizar as tarefas ou exercicios que este propoña de forma autónoma. Unha parte destes exercicios deberá completarse fóra da aula. O profesor supervisará as tarefas a realizar
Prácticas con apoio das TIC	Seminarios en aula de computadores. Realizarase un seguimento personalizado do alumnado durante a clase. Proporanse diferentes exercicios.
Presentación	Presentación dun traballo en clases co obxectivo de demostrar o aprendido durante a realización do traballo e de ensinar ós compañeiros

Atención personalizada

Methodologies	**Description**
Lección maxistral	O seguimento do progreso do alumnado realizarase durante as horas de clase maxistrais e horas de titoría verificando que todos comprenderon as bases e obxectivos. Calquera problema que xurda liquidarase in situ na aula ou en horas de titoría
Prácticas con apoio das TIC	O seguimento do progreso do alumnado realizarase durante as horas de seminario na aula de informática, verificando que todos comprenderon e aprenderon a realizar os cálculos e interpretacións asociadas. Calquera problema que xurda liquidarase in situ na aula ou en horas de titoría.
Resolución de problemas de forma autónoma	O seguimento do progreso do alumnado realizarase durante as horas de seminario na aula de informática, verificando que todos comprenderon e aprenderon a realizar os exercicios e tarefas. Calquera problema que xurda liquidarase in situ na aula ou en horas de titoría.

Presentación	O seguimento do progreso do alumnado realizarase durante as horas de titoría verificando que todos comprenderon as bases e obxectivos. Calquera problema que xurda liquidarase in situ na aula ou en horas de titoría

Avaliación

	Description	Qualification	Training and Learning Results		
Lección maxistral	Avaliarase a participación activa nas clases e nas actividades propostas	10	A2 A3 A5	C10	D11
Resolución de problemas de forma autónoma	Avaliaranse os resultados das tarefas ou problemas propostos	25	A2 A3 A5	C10	D11
Prácticas con apoio das TIC	Avaliarase a participación activa en clases	5	A2 A3 A5	C10	D11
Presentación	O alumnado terá que facer una presentación sobre un tema preparado fora de horas de clase orientado a que os seus compañeiros/as aprendan como a meteoroloxía pode afectar ás operacións aéreas ou espaciais.	20	A2		D11
Exame de preguntas obxectivas	Exporanse preguntas de resposta curta sobre a teoría. Tamén podería incluirse algún exercicio de seminarios	40	A2 A3 A5	C10	D11

Other comments on the Evaluation

A opción de avaliación por defecto en esta asignatura será a avaliación continua. O alumnado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

Para cada unha das probas avaliables, fará falta conseguir polo menos a metade da cualificación total da proba para aprobar.

Avaliación continua:

Para aprobar a materia mediante avaliación continua será obrigatorio asistir a polo menos a 21 horas das 25 presenciais correspondentes ás prácticas en aulas de informática (seminarios) e entregar todas as tarefas propostas para facer fóra da aula (tanto da parte teórica como da parte práctica). Tamén será obrigatorio: i) presentarse á proba escrita, ii) facer o traballo e a presentación do traballo

Ademais o alumnado terá que alcanzar polo menos a metade da nota total en cada unha das tarefas que se cualifican.

Avaliación global

O exame consistirá nunha parte teórica e outra de seminarios, ademais dunha presentación de 10 minutos sobre un tema a acordar coa profesora.

Segunda oportunidade:

100% exame (nota necesaria para aprobar a materia: 5 sobre 10).

En caso de non asistir á proba, ou non aprobala, nas seguintes convocatorias a avaliación será do mesmo xeito que para o resto do alumnado.

Convocatoria fin de carreira

Quen opte por examinarse en fin de carreira será avaliado unicamente co exame (que valerá o 100% da nota). En caso de non asistir a devandito exame, ou non aprobalo, nas seguintes convocatorias a avaliación será do mesmo xeito que para o resto do alumnado.

Datas de exames:

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

González López, Blanca, **Meteorología aeronáutica**, 3, Actividades Varias Aeronáuticas, 2014

Wallace, J.M. Y Hobbs, P, **Atmospheric Science, an introductory survey**, Elsevier, 2006

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

Complementary Bibliography

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

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

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

Holton, J.R., **An Introduction to Dynamic Meteorology**, Academic Press, 2012

OMM, **Guía de Instrumentos y métodos de observación, volúmenes I, III y IV**, 2021

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

https://cloudatlas.wmo.int/es/home.html,

http://www.ogimet.com,

https://skybrary.aero/,

https://resources.eumetrain.org/satmanu/index.html#here,

Bellue, D.G. et al., **Shuttle weather support from design to launch to return to flight**, 2006

Vaughan W. W. y Johnson D. L., **Aerospace meteorology: some lessons learned from the development and application of NASA terrestrial environment design criteria**, 2021

Recomendacións

IDENTIFYING DATA

Information management systems

Subject	Information management systems			
Code	O07G410V01910			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Otero Cerdeira, Lorena			
Lecturers	Otero Cerdeira, Lorena Rodríguez Martínez, Francisco Javier			
E-mail	externo.locerdeira@cud.uvigo.es			
Web	http://aero.uvigo.es			
General description	Introduction to companies information systems regarding their security and management tools. 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.			

Training and Learning Results

Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C3	Basic knowledge about use and programming of computers, operating systems, databases and software with application in engineering.
D5	Capability to solve problems and draw decisions
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject

Expected results from this subject	Training and Learning Results		
New	A2 A3 A5	C3	D5 D11

Contents

Topic	
Information	- Encryption - Storage - Processing - Usage
Information systems	- Information resources - Tools - Transmission of information - Analysis
Security	- Threats and Countermeasures - Cybersecurity - Data protection
Management	- Norms and Certification - Standards - Interoperability - Interfaces between applications

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	36	54
Case studies	15	30	45
Problem solving	13	25	38
Introductory activities	1	1	2
Essay questions exam	2	5	7
Presentation	1	3	4

*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 by the teaching staff of the contents on the subject under study, theoretical bases and / or guidelines of a work, exercise or project to be developed by the student.
Case studies	Analysis of a fact, problem or real event in order to know it, interpret it, solve it, generate hypotheses, contrast data, reflect, complete knowledge, diagnose it and train in alternative solution procedures.
Problem solving	Solve problems and / or exercises related to the subject. The student must develop a correct or correct solution and interpret the results.
Introductory activities	Activities aimed at organizing the subject, gathering sources of information, as well as presenting the content and time planning.

Personalized assistance

Methodologies	Description
Problem solving	The tutorials will be carried out, preferably, by telematic means: email or through the personal office of the teaching staff on the remote campus of the university, within the teaching staff tutoring hours (published on the centre's website). It will be necessary to contact the teachers in advance by email to set the time for the tutoring.

Assessment

	Description	Qualification	Training and Learning Results	
Case studies	Test in which the student must analyze a fact, problem or real event in order to know it, interpret it, solve it, generate hypotheses, contrast data, reflect, complete knowledge, diagnose it and train in alternative solution procedures. Learning outcomes assessed: RA1	10	A2 A3 A5	D11
Problem solving	Periodic individual or group deliveries indicated by the teacher / who will serve as information on the progress of the student and will also be indicators of their attendance. Learning outcomes assessed: RA1	30	A2 A3 A5	D11
Essay questions exam	Partial tests that include open questions about the content of the subject (none exceeds 40%). Students must develop, relate, organize and present the knowledge they have on the subject in a reasoned answer. Learning outcomes assessed: RA1	40	A2 A3 A5	D11
Presentation	Detailed presentation and defense on a specific subject content. Students must demonstrate their understanding of the material and their argumentation skills. Learning outcomes assessed: RA1	20	A2 A3 A5	D11

Other comments on the Evaluation

General remarks:

The student will be able to choose the evaluation system that will be applied to the subject. For this, you must choose, in the first 15 days of the semester, between continuous assessment or exam-only assessment (a single exam at the end of the semester). If you do not specify the type of evaluation desired, it is understood that you opt for continuous evaluation.

The dates and times of the evaluation tests of the different calls are those specified in the evaluation tests calendar approved by the Faculty Board for the 2023-24 academic year.

Continuous assessment tests will be conducted within school hours.

General evaluation criteria:

To pass the subject, the student must obtain, as a final grade, a grade equal to or greater than 5. If in any of the blocks the student obtains a grade lower than 4, even if the average grade is equal to or greater than 5, the subject It will be

suspended and the final grade that will appear in the minutes will be Suspense (4).

Evaluation criteria for attendees 1st call:

All students who choose the continuous assessment modality will be evaluated continuously by taking tests and activities, developed throughout the semester, applying the general evaluation criteria described in the previous section.

Evaluation criteria for non-attendees 1st call:

All students who opt for the non-attendance mode will be evaluated with a single final exam (100% of the grade) that will encompass everything seen throughout the semester, applying the general evaluation criteria described above. The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

Evaluation criteria for 2nd call and end of degree:

In the second opportunity (July) and in the end-of-degree call, students will be evaluated with a single final exam (100% of the grade) that will encompass all the seen throughout the semester, applying the general evaluation criteria described above. maintaining, if applicable, the qualifications obtained for problem solving, case studies, and / or exercises and attendance and participation.

Evaluated competences: the same as in the evaluation system for assistants. Evaluated learning outcomes: the same as in the evaluation system for assistants.

Sources of information

Basic Bibliography

Connolly, T.M.; Begg, C., **Sistemas de bases de datos: un enfoque práctico para diseño, implementación y gestión**, 978-8478290758, 4, Pearson Educación, 2005

Elena Ruiz Larrocha, **Nuevas tendencias en los sistemas de información**, 978-8499612690, Editorial Universitaria Ramón Areces, 2017

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Computer science/O07G410V01104

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	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	Carou Porto, Diego			
Lecturers	Carou Porto, Diego			
E-mail	diecapor@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia presenta unha introdución á enxeñaría e a industrialización do produto cun enfoque práctico e moderno á fabricación de compoñentes aeroespaciais e a enxeñaría de procesos.			

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
C19	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.
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
O/A estudante coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación.	A2 A3 A5	C19	D11
O/A estudante coñece toda a información necesaria para levar a cabo un proceso de produción.	A2 A3 A5	C19	D11
O/A estudante coñece toda a información necesaria para levar a cabo un proceso de produción.	A2 A3 A5	C19	D11
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.	A2 A3 A5	C19	D11

Contidos	
Topic	
Bloque I	1. Deseño de produto 2. Elaboración de prototipos. Fabricación aditiva 3. Conformado de polímeros e materiais compostos. Simulación 4. Conformado por eliminación de material 5. Conformado mediante métodos non convencionais 6. Aplicación de ferramentas CAM na simulación do proceso de mecanizado 7. Automatización. Industria 4.0 no sector aeroespacial 8. Monitorización de procesos 9. Calidade e innovación industrial
Bloque II	Proxectos

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	16	25	41
Prácticas con apoio das TIC	7.5	15	22.5
Aprendizaxe colaborativa	18	12	30
Aprendizaxe baseado en proxectos	1.5	37.5	39
Prácticas de laboratorio	5	8	13
Saídas de estudo	2	0	2
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
Lección maxistral	Exposición por parte do profesor dos contidos fundamentais da materia.
Prácticas con apoio das TIC	Introdución ao emprego de software de simulación de procesos de fabricación por parte do profesor. Coas instrucións recibidas e traballo autónomo, as/os estudantes poderán resolver problemas específicos que permitan mellorar o seu coñecemento sobre os procesos estudados.
Aprendizaxe colaborativa	O profesor proporá traballos a realizar en grupo para aplicar os coñecementos adquiridos.
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 de laboratorio	Fabricación de pezas mediante os medios de fabricación do laboratorio.
Saídas de estudo	Saídas a empresas, centros tecnolóxicos e outras institucións.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.
Aprendizaxe baseado en proxectos	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.
Prácticas con apoio das TIC	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.
Aprendizaxe colaborativa	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.
Prácticas de laboratorio	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.
Saídas de estudo	Prestarase atención ao estudantado tanto no horario lectivo como no de titorías.

Avaliación					
	Description	Qualification	Training and Learning Results		
Lección maxistral	Evaluación de conceptos mediante cuestionario breve	20	A2 A3 A5	C19	
Prácticas con apoio das TIC	Entrega de memorias de prácticas	20	A2 A3 A5	C19	D11
Aprendizaxe colaborativa	Realización dos traballos propostos e entrega de informes, pezas.	30	A2 A3 A5	C19	
Aprendizaxe baseado en proxectos	Entrega memoria de proxecto	30	A2 A3 A5	C19	D11

Other comments on the Evaluation

O modelo de avaliación é avaliación continua. O/A estudante ten dereito a optar pola avaluación global, **EXCLUSIVAMENTE**, según o procedemento e o prazo que estableza o centro para cada convocatoria.

O exame global consistirá nun exame escrito en data oficial que cubra todos os aspectos avaliados en evaluación continua.

PRIMEIRA OPORTUNIDADE:

A materia se avalía en base a:

-Memoria do proxecto (nota máxima 3 puntos).

-Prácticas TIC (nota máxima 2 puntos). Entrega obrigatoria de memorias de prácticas nas datas estipuladas.

-Aprendizaxe colaborativo (nota máxima 3 puntos). Se deberá participar nas actividades propostas durante o curso e presentar as pezas e informes solicitados. Este apartado será avaliado en grupo.

-Cuestionario breve (nota máxima 2 puntos)

Aprobarán a materia aqueles estudantes que consigan unha nota igual ou superior a 5 puntos.

SEGUNDA OPORTUNIDADE:

O método de avaliación é o mesmo que o descrito para a PRIMEIRA OPORTUNIDADE.

Se poderán gardar as partes da primeira oportunidade con calificación >5.

OUTRAS CONSIDERACIÓNS:

As/os estudantes non-asistentes serán avaliados cun exame final que cobre 100% das competencias da materia.

As actividades de laboratorio non se poderán recuperar unha vez finalizadas as datas fixadas.

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

A evaluación fin de carreira seguirá os mesmos criterios ca evaluación de 2ª oportunidade.

Bibliografía. Fontes de información
Basic Bibliography
Mikell P. Groover, **Fundamentos de manufactura moderna : materiales, procesos y sistemas**, 3, Prentice-Hall, 2007
S. Kalpakjian, S.R. Schmid, **Manufactura, Ingenieria y Tecnología**, 7, Pearson Education, 2014
Mikell P. Groover, **Automation, production systems, and computer-integrated manufacturing**, 4, Pearson, 2016
Complementary Bibliography
T. Black, R. Kohser, **Degarmo´s Materials and Processes in Manufacturing**, 12, Wiley, 2017
John G. Nee, **Fundamentals of Tool Design**, 6, SME, 2010
Sham Tickoo, **Catia v5-6 R2014 for designers**, 12, Shererville IN: CADCIM Technologies, 2015
Egberto Garijo Gómez, **Diseño y fabricación con CATIA v5 : módulos CAM : mecanización por arranque de viruta**, 1, Visión Libros,, 2012
D. Carou, J.P. Davim, **Machining of Light Alloys Aluminum, Titanium, and Magnesium**, 1, CRC Press, 2019
D. Carou, **Aerospace and digitalization**, 1, Springer, 2021
Piers Bizony, **The art of NASA : the illustrations that sold the missions**, 1, Motorbooks, 2020
Helmi Youssef; Hassan El-Hofy, **Non-Traditional and Advanced Machining Technologies**, 2, CRC Press, 2021

Recomendacións

Subjects that it is recommended to have taken before
Fabricación aeroespacial/O07G410V01501

IDENTIFYING DATA				
Solid mechanics and aerospace structures				
Subject	Solid mechanics and aerospace structures			
Code	O07G410V01921			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	3rd	1st
Teaching language	Spanish Galician			
Department				
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://http://aero.uvigo.es/			
General description	Introduction to the mechanics of solids and aeronautical structures. 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
C26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
C33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results		
Understanding of the equations and general principles of the continuous medium, as well as the appropriate selection of the different models of deformable solid behavior.	A2	C26 C33	D4 D5 D11
Analysis of solids and structures subjected to stresses in excess of yield stress and cyclic loading	A3 A5	C20	D4 D6 D8 D11
Knowledge, understanding, application, analysis and synthesis of structural theory	A3 A5	C26 C33	D3 D4 D5 D6 D8 D11

Knowledge of the most important aspects of aircraft structural behavior	A2 A3	C20 C26 C33	D4 D5 D8

Contents	
Topic	
Introduction to the characteristics and configuration of the aeronautical structures.	- Loads on the structure. - Structural elements. Structure of the fuselage: monocoque, semimonocoque. Structure of wing and of tail.
Symmetrical structures.	- Symmetrical structures.
Efforts produced by bending moments and shear forces	- Theorem of the sharp flow. - Sharp efforts. - Combined bending in symmetrical structures.
Torsion.	- Sections no circular. Rectangular section. - Open sections of small thickness. Enclosed sections of small thickness. Enclosed multicellular sections. - Centre of torsion. - Bending-Torsion.
Analysis of tensions in wings.	- Analysis of tensions in wings.
Analysis of tensions in fuselages.	- Analysis of tensions in fuselages.
Introduction to the structural integrity	- Requirements of resistance and rigidity. Factor last of security. - Fatigue. Criteria of fatigue based in tensions. - Criteria of fatigue based in deformations. - Introduction to the mechanics of the fracture. Criteria of tolerance to the damage. Margin of security and factor of reservation.
Elements subjected to axial forces and bending moments	- Elements subjected to axial forces and bending moments. Ultimate bending moment.
Problems of buckling and instabilities.	- Introduction to the theory of the stability - Global buckling. Primary instability of columns of stable section. - Beam-column buckling. Crippling. - Instability of flat and curved panels - Local buckling of of thin wall beams - Stiffened panels. Failure modes for compression and shearing.
Unions in aeronautical structures.	- Unions in aeronautical structures.
Theory of plates and shells	- Structural elements type plate and shell. - Basic hypotheses of calculation. - Flexure of plates and shells. - Plate buckling.
Finite elements method (FEM).	- Linear static analysis with elements type sweep, elasticity 2D and 3D, plates and shells. - Introduction to software of FEM simulation - Structural instability. Buckling by FEM. - Introduction to the static analysis no-linear of structures: no-geometrical linearity, no-linearity of the material (plasticity), no-linearity been due to boundary conditions.

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	47	56	103
Laboratory practical	24	30	54
Autonomous problem solving	0	60.5	60.5
Essay questions exam	3.5	0	3.5
Objective questions exam	2	0	2
Problem and/or exercise solving	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	Exhibition in the classroom of the basic knowledges of the matter.
Laboratory practical	Realisation of practices in laboratory and/or realisation of practices in computer classroom and/or resolution of practical problems.
Autonomous problem solving	Resolution of problems and/or exercises of autonomous form by part of the students.

Personalized assistance

Methodologies	Description
Laboratory practical	In the practices will try in the measure of the possible attend personally to all the doubts that arise along the development of the practices
Autonomous problem solving	Once resolved, the professors will assist in person the students that have doubts on any of the contents subjected to assessment

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practical	Attendance and active participation in all practical classes will be valued, and the delivery on time of all the documentation requested in the same. It will be scored with the indicated value, as long as at least 50% of the sum of the possible grade in the rest of the evaluation tests is reached.	10	A2 A3	C20 C26 C33	D3 D4 D5 D8 D11
Essay questions exam	Examination at the end of the course on the whole of the content addressed by the subject.	30	A2 A5	C20 C26 C33	D3 D4 D5 D6 D8
Objective questions exam	Proof that that includes questions with different alternative of answer. The student selects an answer between a number limited of possibilities. In the dates established by the centre when concluding the teaching of the matter.	30	A2 A3	C20 C26 C33	D3 D4 D5 D8
Problem and/or exercise solving	Proof in which the student has to solve a series of problems and/or exercises in a time/condition established/ace by the educational team.	30	A2 A3 A5	C20 C26	D3 D4 D5 D8

Other comments on the Evaluation

The evaluation will be of a continuous nature, unless students waive it through the appropriate official procedure. In this case, the evaluation will be done exclusively by means of a written examination, which will count for 100% of the grade. This specific method of evaluation is called global evaluation. The grade obtained for the laboratory practices (10%) will be retained for the evaluation at the second opportunity and end of degree call. The remaining 90% of the grade will be obtained by means of a written exam, on the dates established by the Center, on theoretical and/or practical content. The laboratory exercises will be evaluated with the indicated value, as long as at least 50% of the possible grade is obtained in the exam.

Students who officially renounce continuous assessment

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

The student has the right to opt for the global evaluation according to the procedure and the term established by the center for each call.

Laboratory practices

The classroom part corresponding to each internship is carried out on a specific date, so it is not possible to make up for absences. Those practices in which the student presents an official justification (doctor, court,...) due to unavoidable reasons of force majeure will be excused.

Assessment tests

The evaluation test schedule officially approved by the EEAE Center Board can be found on the website: http://aero.uvigo.es/gl/docencia/exames. The maximum duration of the exam will be 3 hours if there is no break or 5 hours if there is an intermediate break (with a maximum of 3 hours for each part).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The fact of introducing an unauthorized electronic device into the exam room will be considered a reason for failing the subject in this academic year and the overall grade will be fail (0.0).

Ethical commitment

In case of detection of copying in any of the tests (short tests, partial exams, or final exam) the final grade will be SUSPENSED (0.0) and the fact will be communicated to the Center's management for the appropriate effects.

Observation

In case of discrepancy in the versions of this guide between languages, the Spanish version prevails.

Sources of information

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

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

Recommendations

Subjects that it is recommended to have taken before

Graphic expression: Graphic expression/O07G410V01105
Physics: Physics I/O07G410V01103
Physics: Physics II/O07G410V01202
Mathematics: Linear algebra/O07G410V01102
Mathematics: Calculus I/O07G410V01101
Mathematics: Calculus II/O07G410V01201
Materials science and technology/O07G410V01304
Mathematics: Statistics/O07G410V01401
Classical mechanics/O07G410V01305
Resistance of materials and resilience/O07G410V01405
Thermodynamics/O07G410V01303

IDENTIFYING DATA				
Fluid mechanics II and CFD				
Subject	Fluid mechanics II and CFD			
Code	O07G410V01922			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	3rd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Suárez Porto, Eduardo			
Lecturers	Rodríguez Pérez, Luis Suárez Porto, Eduardo			
E-mail	suarez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Knowledge, understanding, and application of Fluid Mechanics concepts and techniques in Aerospace Engineering. A portion of the course introduces computational fluid dynamics (CFD), building on students' knowledge of fluid conservation equations acquired in previous courses. This allows students to perform basic simulations involving fluids as the medium. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
C22	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.
C25	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.
C26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
C28	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.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results		
Knowledge and understanding of the principal concepts and techniques in Fluid Mechanics	A3	C22 C28	D4 D5 D8 D11

Ability to apply the principal concepts and techniques of Fluid Mechanics to Engineering Sciences.	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11
Understanding of the basic procedures of computational fluid dynamics	A5	C22 C25 C26 C28	D4 D5 D8 D11

Contents	
Topic	
CFD. General equations and transport phenomena	Topic 1: Summary of the general equations. Integral notation Differential notation Conservative form. Compact notation Most common limit models Most common boundary conditions
CFD. Turbulence	Topic 2: Introduction to turbulence Introduction Kolmogorov scale Infeasibility of direct numerical simulation Turbulence models: RANS models: -Reynolds and Favre averages -Averaged equations. Apparent Reynolds stresses. closure problem - Boussinesq hypothesis: algebraic models, of one equation and of two equations - Wall laws. High and low Reynolds number models - Reynolds apparent stress transport models LES Models: Description
CFD. Introduction to Computational Fluid Dynamic	Topic 3: FVM methods of numerical resolution of the Navier-Stokes equations. Finite Volume Methods (FVM): - Introduction - Discretization of the computational domain - Discretization of fluid equations - Discretized equations in FVM - Discretization of boundary conditions incompressible flows. pressure equation - Artificial compressibility methods - Pressure-velocity couplings - Most common numerical resolution acceleration methods Topic 4: Introduction to the use of different software (OpenFoam and Fluent*) for numerical simulation of fluids. Practices in computer room. *The use of these software will be conditioned to the availability of use licenses by of the center as well as the correct installation of the same in the assigned computer room Applications: - Laminar flow inside a cavity - Flow in a stream mixing device - Aerodynamic forces on bodies: Flow around an obstacle. Laminar flow and turbulent flow Calculation of Von Kármán vortex street behind a blunt body Incompressible flow over airfoil Transonic flow over airfoil -Numerical simulation exercises/projects to be resolved more independently by students.

Fluid Mechanics II. Ideal flows. Irrotational flows.	Topic 1. Ideal Fluids. Euler's Equations: Introduction. Flows at High Reynolds Numbers. Bernoulli's Equation. Pitot Probes. Stagnation conditions. Quasi-Stationary Motion Topic 2: Irrotational movements. Irrotationality conditions Irrotational Equations of Motion Initial and boundary conditions irrotational movement of liquids superposition principle Speed potential at great distances from an obstacle Irrotational plane motion of liquids: Elementary solutions. Current in nooks and corners. Current around a cylinder with circulation Two-dimensional irrotational motion of gases Prandtl–Meyer expansion
Fluid Mechanics II. Movements with surfaces of discontinuity	Topic 3: Movements with surfaces of discontinuity Equations for the jump of fluid magnitudes in a discontinuity Normal and tangential discontinuities normal shock waves oblique shock waves Application: Almost one-dimensional movement of ideal fluids: Critical area. Movement in nozzles. Loading and unloading in warehouses. Shock waves. Relation of Hugoniot.
Fluid Mechanics II. One dimensional unsteady flow of ideal fluids	Topic 4: Unsteady One-Dimensional Motion of Ideal Fluids Compressibility Effect on Liquids Valve Opening and Closing. Water Hammer Equations of Unsteady One-Dimensional Motion in Gases. Simple Waves
Fluid Mechanics II. Boundary layer	Topic 5: Laminar boundary layer Incompressible laminar boundary layer. similarity solutions. Boundary layer on flat plate. Blausian solution Compressible laminar boundary layer Thermal boundary layer at low speeds
Fluid Mechanics II. Laboratory practicals	-Aerodynamic bench test: boundary layer measurement - Low speed wind tunnel test Pressure distribution on blunt body - Pressure distribution in convergent and convergent-divergent nozzles. Shock waves. sonic blocking

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	4	5	9
Lecturing	33	35	68
Project based learning	8	18.5	26.5
Practices through ICT	8	0	8
Problem solving	22	73	95
Project	0	15	15
Essay questions exam	1.5	0	1.5
Essay questions exam	1	0	1
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
Laboratory practical	Conducting laboratory
Lecturing	Presentation of theory Translation of fluid problems into mathematical models for numerical resolution
Project based learning	Formulation and numerical resolution of proposed problems applied to fluid flows
Practices through ICT	Formulation and resolution of models applied to fluid flows.
Problem solving	Independent resolution of problems and/or exercises by the student to comprehend and characterize different types of fluid movements and their simplifications

Personalized assistance

Methodologies	Description
Laboratory practical	All doubts that arise during the practical sessions will be addressed personally.
Problem solving	As far as possible, all questions that arise during the problems solving will be addressed.
Practices through ICT	In the practical sessions, we will aim to organize the students into different groups for various activities whenever possible. All questions that arise during the practical sessions will be addressed

Tests	Description
Project	Doubts that arise throughout the development of the project will be addressed in tutorials

Assessment

	Description	Qualification	Training and Learning Results		
Project based learning	Preparation and submission of the proposed CFD simulation report to the student	20	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11
Practices through ICT	Assistance and active participation in CFD practicals	1.5	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11
Problem solving	Attendance to the problem-solving sessions and submission of the proposed problems.	3.5	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11
Essay questions exam	Completion of written tests, resolution of exercises, and analysis of practical cases	30	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D8
Essay questions exam	Completion of written tests, resolution of cases and CFD concepts.	10	A2 A3 A5	C20 C26 C28	D3 D5 D8 D11
Essay questions exam	Completion of written tests, resolution of exercises, and analysis of practical cases. MFII	35	A3 A5	C22 C25 C26	D4 D5 D8

Other comments on the Evaluation

First exam call: The evaluation system will be continuous assessment for all students, nevertheless the student has the right to opt for the exam-only assessment according to the procedure and the deadline established by the centre for each exam call, in which case they will have the possibility of taking a final exam, which is hours long, (with a break) and has a weight of 100% of the grade.

If a student participates in any of the qualifying tests during the continuous assessment, he/she will be considered as having attended the course. Continuous assessment is valid until the second exam call, so the grades achieved in all previously-completed activities, will be retained until the second exam call (July), and will not carry over to the following year.

The continuous assessment of the course will be conducted through the following tests and their corresponding weights:

35% Written continuous assessment test on knowledge of MFII.

30% Written continuous assessment test on knowledge of MFII.

20%. Submission of the CFD Project/s for numerical simulation assigned to the students by the teaching staff.

10% Continuous assessment written test on CFD knowledge

3.5% Attendance, submission of problems assigned by the faculty, and active participation in practical classes and MFII problem solving.

1.5% Attendance, submission of problems assigned by the teaching staff, and active participation in the CFD practical classes.

To pass the course, a minimum score of 2 out of 10 must be achieved on each test, and an overall score of 5 out of 10 is required for total evaluations.

Second call: All qualifications obtained in the continuous assessment tests from the first session can be retained for the second call. Students may choose which activities to retake in the second call, except for those related to attendance.

End-of -program exam call: Exam-only assessment option with a weight of 100% of the grade.

Students are expected to exhibit appropriate ethical behaviour. If unethical behaviour (such as copying, plagiarism, use of unauthorized electronic devices) is detected, it will be deemed that the student does not meet the necessary requirements to pass the course. Depending on the type of unethical behavior, it may be concluded that the student did not acquire the required skills.

The use of any electronic device during evaluation tests is prohibited unless expressly authorized. Introducing an unauthorized electronic device into the exam room will be considered grounds for failing a course in that academic year, resulting in an overall grade of 0.0.

Sources of information

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,

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Mathematical methods/O07G410V01301
Fluid mechanics/O07G410V01402

Other comments

Dedicate the specified time to assigned personal word and seek personal tutorials with the instructor to address any questions than may arise during the student's independent study.

Regular attendance and active participation in class are strongly recommended for the course.

IDENTIFYING DATA				
Aerodynamics and aeroelasticity				
Subject	Aerodynamics and aeroelasticity			
Code	O07G410V01923			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	García Luis, Uxía			
Lecturers	García Luis, Uxía			
E-mail	uxia.garcia.luis@uvigo.gal			
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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
C22	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.
C25	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.
C26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
C28	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.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results		
- Knowledge, understanding, application and analysis of the aerodynamic phenomena and of the laws that govern his performance;	A2 A3	C22 C26 C28	D3 D4
- Knowledge, understanding and synthesis of the foundations of the flight of the aircraft	A3 A5	C22 C25 C26	D5 D6
- Knowledge, understanding, application, analysis and synthesis of the methods applied to the study of aeroelasticity;	A2 A3	C20 C25 C28	D8 D11

- 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)	A3 A5	C20 C25 C28	D3 D4
- Knowledge, understanding, application, analysis and synthesis of aeroelasticity of one-dimensional and two-dimensional structures.;	A3	C20 C22 C26	D6 D8
- Knowledge and understanding of the most important appearances of experimental aeroelasticity, and more specifically of the essays in earth and in flight of aerostructures	A5	C20 C25	D8

Contents

Topic	
1. Aerodynamics of flow incompresible	Subject 1.1: Introduction Subject 1.2: Foundations and principles of the aerodynamic Subject 1.3: Foundations of the flow incompresible Subject 1.4: Flow incompresible on profiles Subject 1.5: Flow incompresible on finite wings Subject 1.6: Flow incompresible three-dimensional
2. Aerodynamics of compressible flow	Subject 2.1: Aerodynamics in compressible subsonic regime. Linear theory of compressible flow in airfoils Subject 2.2: Introduction to aerodynamics in compressible transonic regime. Subject 2.3: Introduction to aerodynamics in compressible supersonic regime.
3. Aeroelasticity	Subject 3.1: Introduction to the aeroelasticity Subject 3.2: Aeroelasticity static Subject 3.3: Aeroelasticity dynamic

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	10	25
Previous studies	0	26.5	26.5
Mentored work	6	20	26
Problem solving	18.5	55	73.5
Workshops	2	0	2
Lecturing	30	10	40
Essay questions exam	5	0	5
Report of practices, practicum and external practices	0	20	20
Presentation	2	5	7

*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 practices programmed using the wind tunnel and manufacturing processes of test models. The realisation of the practice requires the preparation of it by means of a previous design, the assistance to the sessions of practices and the realisation of a report by the 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
Mentored work	The mentored work consists on the development of a aerodynamic project based on aircraft airfoils and wings. The work is done by groups of students, and they have booked sessions with the professor for monitoring and tutoring.
Problem solving	Resolution of problems and/or exercises that treat punctual topics 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	Training and Learning Results		
Mentored work	The mentored work consists on the development of a aerodynamic project based on aircraft airfoils and wings. The work is done by groups of students, and they have booked sessions with the professor for monitoring and tutoring.	25	A2 A3	C20 C22 C26 C28	D3 D4 D5 D6 D8
Essay questions exam	- Midterm Exam 1 based on problem-solving and/or conceptual questions covering the course content from Topics 1 to 2 -> 30% - Midterm Exam 2 (to be taken on the official date) based on problem-solving and/or conceptual questions covering the course content from Topics 2 to 3 -> 30%	60	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11
Report of practices, practicum and external practices	Report of the works made in the laboratory	5	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D6 D11
Presentation	Group presentation of the mentored work.	10	A2 A3 A5	C20 C22 C25 C26 C28	D3 D4 D5 D6 D8 D11

Other comments on the Evaluation

First call

(1) Students following the course through Continuous Assessment

To pass the subject during the first call via Continuous Assessment, the following requirements must be met:

- A minimum grade of 4 in each of the assessable components of the subject (mentored project, presentation, essay questions exams and practical report).

- A minimum average grade of 5 across the two partial development-question exams.

- Attendance of at least 90% of the practical sessions.

Additionally, students who did not obtain a grade lower than 5 in Partial Exam 1 may retake the exam covering the same topics on the official exam date. Only those who scored between 4 and 5 are not required to retake it, as a minimum grade of 4 is necessary to pass.

If these conditions are not met, the final grade will be the lower of the weighted average from Continuous Assessment and 4.9.

(2) Students opting for Global Assessment

By default, the subject will be evaluated through Continuous Assessment during the first call. However, students have the right to opt for Global Assessment following the procedure and deadlines established by the institution for each exam period.

The grade obtained in the Global Assessment exam will represent 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may include a component to be completed in a computer room and/or laboratory, and it will cover all course content, including material from practical sessions and projects.

Second Call and Final Year Evaluation

Students who do not pass the subject in the first call may take an exam that will count for 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may include a component to be completed in a computer room and/or laboratory and will cover the full content of the course, including all practical sessions and projects.

In cases where plagiarism is detected in any assessment component, the grade for that submission will be 0, and the case

will be reported to the relevant authorities at the institution for appropriate action.

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
José Meseguer Ruiz, Ángel Sanz Andrés, **Aerodinámica básica**, 2ª, Gaceta, grupo editorial, 2010
Complementary Bibliography

Recommendations
Subjects that continue the syllabus
Mechanics of flight/O07G410V01924
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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
Web	http://aero.uvigo.es			
General description	Flight mechanics encompasses the study of the performance, stability, and static and dynamic control of aerospace vehicles, with a focus on fixed-wing aircraft in this course. It also covers flight qualities and testing. 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
C23	Appropriate knowledge applied to engineering: physical phenomena of flight, its qualities and its control, aerodynamics, propulsive forces, active control and stability.
C26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
C31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
C33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results			
Knowledge of the most stood out appearances of the qualities of flight and the essays in flight of the aircraft	A5	B6	C23 C33	D8 D11
Knowledge, understanding, application, analysis and synthesis of the performances, the stability and controlabilidad static and dynamic of the aircraft.	A2 A3		C26 C31	D3 D4 D5 D6

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 motion.

2. Performances of gliders and aeroplanes powered by jet engines and by alternative engines.	2.1. Performances of gliders 2.2. Performances of jet-powered aeroplanes in horizontal straight flight 2.3. Performances of jet-powered aeroplanes in other type of flights 2.4. Performances of aeroplanes powered 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 Flight Qualities and Flight Tests.	4.1. Introduction to Flight Qualities and Flight Tests

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	28	0	28
Lecturing	22	0	22
Autonomous problem solving	0	80	80
Mentored work	0	17.5	17.5
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 addressing specific aspects of the course content, developed by the instructor and/or the students in the classroom.
Lecturing	Presentation of a topic by the instructor following a previously established outline
Autonomous problem solving	Independent study by the student, with support from the instructor as needed, in accordance with the procedures established by the university
Mentored work	The mentored work involves the preparation of an aircraft design project using the concepts learnt in the Flight Mechanics course. Additionally, it will be necessary to review key concepts of the Aerodynamics and Aeroelasticity course. The project will be conducted in groups.

Personalized assistance

Methodologies	**Description**
Mentored work	The mentored work involves the preparation of an aircraft design project using the concepts learnt in the Flight Mechanics course. Additionally, it will be necessary to review key concepts of the Aerodynamics and Aeroelasticity course. The project will be conducted in groups.
Autonomous problem solving	Independent student study, with support from the professor if needed, in accordance with the procedures established by the university.

Assessment

	Description	Qualification	Training and Learning Results			
Mentored work	The mentored work consists of the preparation of a project of design project.	30	A2 A3 A5	B6	C23 C26 C31 C33	D4 D5 D6 D8 D11
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the course.	40	A2 A3 A5	B6	C23 C26 C31 C33	D3 D4 D5 D8 D11

Other comments on the Evaluation

By default, the evaluation is assumed to be continuous. The student has the right to opt for the global evaluation according to the procedures and deadlines established by the center for each call.-

Continuous assesment:-

At the first exam call:

A partial, redeemable exam covering part of the course content will be held during the term. To pass this exam and be exempt from that portion of the course, a grade of 5 out of 10 is required. However, if the grade exceeds 4 out of 10, this portion can still be passed if the other sections of the course bring the overall final grade to at least 5 out of 10. The weight

of this test in the final grade is 30%..

A final exam will be held on the official date set by the center. The written test will consist of two parts: a first part for students who passed the partial exam, with a weight of 40% in the final grade; and a second part, for students who did not pass the partial exam (with a weight of 30%)

A group (or indiividual) project will be conducted, contributing 30% to the final grade. Each member of the group may receive a different individual grade (in case of groupal project)

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The minimum grade required in any test is 4 out of 10 in order to balance the exam and practicals. To pass the course, weighted grade of 5 out of 10 (including written exams and assignments) must be acheived. The written tests may consist of multiple-choice questions and/or short-answer questions and/or essay-type questions.

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In the second exam call:

-

Students who have not passed the subject at the first call will take an exam that covers all aspects of the subject, on the official date indicated by the center.

-

To pass the course, a minimum grade of 5 out of 10 must be achieved. The exam may consist of test-type questions and/or short-answer questions and/or essay-type questions.

-

Exam-only assesment/End-of-program call:

-

A final exam will be held on the official date set by the center, which will cover all aspects of the subject.

-

To pass the course, a minimum grade of 5 out of 10 must be achieved. The exam may consist of test-type questions and/or short-answer questions and/or essay-type questions.

If plagiarism is detected in any graded item, a grade of 0 will be assigned for that item, and the incident will be reported to the Center's management for appropriate action.

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

Complementary Bibliography

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

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

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Cuiñas Gómez, Íñigo			
Lecturers	Cuiñas Gómez, Íñigo			
E-mail	inhigo@uvigo.gal			
Web	http:// aero.uvigo.es			
General description	Introduction to systems engineering and to comunication systems 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.			

Training and Learning Results	
Code	
B4	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.
C19	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.
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results		
Compression, knowledge of the systems of communications in aerospace vehicles	B4	C19	D5 D6 D8 D13

Contents	
Topic	
Concept of Systems Engineering	Need for Systems Engineering. Simple examples
National and international standards Systems Engineering in Aerospace projects	Study of the most used standards in: Aerial systems Spatial systems Common points
Application to national and international projects of Systems Engineering.	Examples: Aerial system: commercial aerial navigation Apatial aystem: nano-pico 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	75.5	105.5
Laboratory practical	20	22	42
Problem and/or exercise solving	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	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 group 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. This is a group activity.

Personalized assistance

Methodologies	Description
Lecturing	Tutor sessions will be scheduled by the lecturer when a student sends an email asking for it. They will be at the lecturer's virtual office. https://moovi.uvigo.gal/user/profile.php?id=118183
Laboratory practical	In the practices of laboratory the student can ask lecturer to resolve doubts. Tutor sessions will be scheduled by the lecturer when a student sends an email asking for it. They will be at the lecturer's virtual office.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	Evaluation of group work and individual questions during the practical sessions. Cross assessment surveys can vary final marks as well. Also, cross assessment surveys may affect the marks. The continuous assessment tests will be carried out during the lectures' schedule.	20	B4 C19 D5 D6 D8 D13

Problem and/or exercise solving	Tests will have short practical questions and theoretical questions about the contents of magistral lectures. There will be two tests during the course: one about the middle of course about the first half of subject and other at the end of lectures. These tests worth 40% of final mark. The second test will cover the second half of the subject for students who have got a mark better than 3/10 in the middle course test. If a student didn't got a mark over 3/10 in both tests, or does not have an average higher tan 5/10, or wants to improve mark, will make the final test about all subject. In this case, only the final exam grade will be considered, renouncing the results of the half part exams. The continuous assessment tests will be carried out during the lectures' schedule.	80	B4	C19	D5 D8

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 assessment. The first and second calls 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

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

The student has the right to opt for the global assessment according to the procedure and the deadline established by the centre for each call.

In the End-of-program exam, the criteria shall be the same as in the extraordinary exam.

Sources of information

Basic Bibliography

Jean-Luc Voirin, **Model-based System and Architecture Engineering with the Arcadia Method: https://www.elsevier.com/books/model-based-system-and-architecture-engineering-with-the-arcadia-method/voirin/978-1-78548-169-7**, 1, Elsevier (Free download from the University), 2017

Pascal Roques, **Systems Architecture Modeling with the Arcadia Method: https://www.elsevier.com/books/systems-architecture-modeling-with-the-arcadia-method/roques/978-1-78548-168-0**, 1, Elsevier (Free download from the University), 2017

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,

Complementary Bibliography

NASA, **System engineering handbook**, Rev. 1,

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

Recommendations

Subjects that it is recommended to have taken before

Electronics and automation/O07G410V01403

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

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B1	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.
B7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.
C21	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos de sustentabilidade, mantenibilidad e operatividade dos vehículos aeroespaciais.
C23	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.
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
D13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados previstos na materia				
Expected results from this subject	Training and Learning Results			
- Coñecer as necesidades propulsivas das aeronaves	A2 A3 A5		C23	
- Coñecer os empuxes e resistencias relacionados cos aerorreactores	A2 A3 A5	B1	C23	
- Coñecer e cuantificar de forma aplicada o proceso de combustión dos aerorreactores e o rendemento da combustión	A2 A3 A5	B1	C21	D13
- Saber realizar un balance enerxético diferenciando e calculando os rendementos involucrados	A2 A3 A5			
- Saber resolver problemas relacionados co cálculo dos ciclos termodinámicos e as características dos aerorreactores; así como o efecto das características e calidade dos compoñentes	A2 A3 A5			

- Coñecer os diferentes aerorreactores e saber obter os sistemas óptimos baixo o punto de vista propulsivo	A2 A3 A5	B7		
- Dimensionar os compoñentes que interveñen no sistema propulsivo	A2 A3 A5	B7		
- Coñecer o efecto das condicións de voo: velocidade e altitude no funcionamento dos aerorreactores	A3 A5	B1	C23	
- Coñecer os problemas ambientais dos aerorreactores e as súas posibles solucións	A2 A3 A5	B7	C21	D13
- Redactar informes técnicos e facer exposicións orais técnicas relacionadas co anterior	A2 A3			D3 D4 D6 D8 D11
- Resolver problemas derivados do ámbito da materia de forma autónoma e en colaboración con outro	A2 A3			D3 D4 D6 D8
- 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	A2 A3 A5		C21 C23	D8
- Coñecemento dos aspectos máis destacados dos ensaios dos motores alternativos	A2 A3 A5	B7	C21 C23	
- Utilizar ferramentas informáticas de cálculo de actuacións de aerorreactores	A2 A3 A5	B1	C23	D4 D8

Contidos	
Topic	
1.- Motores alternativos de combustión interna	1.1.- Necesidades propulsivas das aeronaves 1.2.- Ciclos 1.3.- Renovación da carga 1.4.- Alimentación de combustible 1.5.- Combustión 1.6.- Sobrealimentación 1.7.- Turboalimentación 1.8.- Actuacións 1.9.- Elementos construtivos do motor alternativo
2.- Aerorreactores	2.1.- Turbinas de gas 2.2.- Análises do ciclo dun aerorreactor 2.3.- Aplicación das ecuacións integrais da Mecánica de Fluídos aos Aerorreactores: Continuidade: gasto másico; Cantidade de movemento: empuxes e resistencias; Enerxía: rendementos 2.4.- Comportamento motor e propulsor dos aerorreactores 2.5.- Turbohélices e a súa optimización 2.6.- Turbofanes e a súa optimización; turbofanes de fluxo mesturado; turbofanes avanzados 2.7.- Sistemas incrementadores de empuxe 2.8.- Actuacións de compoñentes 2.9.- Actuacións de aerorreactores 2.10- Problemas ambientais derivados do funcionamento dos aerorreactores

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	27.5	0	27.5
Prácticas de laboratorio	20	0	20
Estudo previo	0	60	60
Resolución de problemas de forma autónoma	0	26	26
Exame de preguntas de desenvolvemento	0.75	0	0.75
Resolución de problemas e/ou exercicios	0.5	0	0.5
Exame de preguntas de desenvolvemento	0.75	0	0.75
Resolución de problemas e/ou exercicios	0.5	0	0.5

Informe de prácticas, prácticum e prácticas externas 0	14	14

*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	Docencia en aula con apoio audiovisual
Prácticas de laboratorio	Prácticas de laboratorio, prácticas informáticas e saídas de estudo
Estudo previo	Preparación para o seguimento da materia, procura de información e preparación das probas de avaliación
Resolución de problemas de forma autónoma	

Atención personalizada

Tests	Description
Exame de preguntas de desenvolvemento	Prestarase atención colectiva e/ou persoalmente ás dúbidas que xurdan ao longo do desenvolvemento das probas escritas
Resolución de problemas e/ou exercicios	Prestarase atención colectiva e/ou persoalmente ás dúbidas que xurdan ao longo do desenvolvemento das probas escritas
Exame de preguntas de desenvolvemento	Prestarase atención colectiva e/ou persoalmente ás dúbidas que xurdan ao longo do desenvolvemento das probas escritas
Resolución de problemas e/ou exercicios	Prestarase atención colectiva e/ou persoalmente ás dúbidas que xurdan ao longo do desenvolvemento das probas escritas
Informe de prácticas, prácticum e prácticas externas	Atenderase persoalmente a todas as dúbidas que xurdan ao longo do desenvolvemento das prácticas e atenderase en titorías as dúbidas que xurdan ao preparar o informe de prácticas

Avaliación

	Description	Qualification	Training and Learning Results			
Exame de preguntas de desenvolvemento	Exame escrito de preguntas curtas e resolución de problemas	20	A2 A3 A5	B1 B7	C21 C23	D3 D4 D8 D11 D13
Resolución de problemas e/ou exercicios	Exame escrito de solución de problemas Tema Motores de Combustión Interna Alternativos	20	A2 A3 A5	B1 B7	C21 C23	D3 D4 D8 D11 D13
Exame de preguntas de desenvolvemento	Exame escrito de preguntas Tema Aerorreactores	20	A2 A3 A5	B1 B7	C21 C23	D3 D4 D8 D11 D13
Resolución de problemas e/ou exercicios	Exame escrito de solución de problemas Tema Aerorreactores	20	A2 A3 A5	B1 B7	C21 C23	D3 D4 D8 D11 D13
Informe de prácticas, prácticum e prácticas externas	Informe das prácticas de laboratorio (solución dos exercicios propostos nas sesións de prácticas)	20	A2 A3 A5	B1 B7	C21 C23	D3 D4 D6 D8 D11 D13

Other comments on the Evaluation

O calendario de probas de evaluación aprobado oficialmente pola Xunta de Centro dá EEAE publícase na web http://aero.uvigo.es/gl/docencia/exames/.

Evaluación continua (primeira oportunidad)

Para superar a materia na evaluación continua na primeira convocatoria se requerirá obter unha calificación superior a 5 puntos sobre 10 na valoración conxunta da evaluación continua durante o desenvolvemento das clases e o exame na data oficial (é condición necesaria obter unha puntuación mínima de 4 puntos sobre 10 en cada unha das probas). A calificación final se obtendrá de acordo ás porcentaxes indicadas. As probas puntuables da evaluación continua se realizarán durante as horas lectivas da materia, polo que se require a asistencia regular ás clases e prácticas por parte do alumnado.

Evaluación global (primeira oportunidad, segunda oportunidad)

O/A estudante ten dereito a optar pola evaluación global según o procedemento e o prazo que estableza o centro para cada convocatoria.

O/A estudante deberá presentarse ao exame de segunda convocatoria de todos os contidos da materia, que supondrá o 100% da nota, nos seguintes supostos:

- A non realización dalgunha das probas da evaluación continua dentro dos prazos establecidos para os mesmos

- Obter unha nota inferior a 5 puntos sobre 10 na valoración conxunta da evaluación continua

- Obter unha nota inferior a 4 puntos sobre 10 nunha ou varias das probas da evaluación continua

- Obter unha nota inferior a 5 puntos sobre 10 na valoración da evaluación global (para estudantes que optasen a evaluación global en primeira convocatoria)

Evaluación fin de carreira

Para superar a materia na evaluación fin de carreira se requerirá obter unha calificación superior a 5 puntos sobre 10 no exame de todos os contidos da materia, que supondrá o 100% da nota.

Bibliografía. Fontes de información

Basic Bibliography

F. PAYRI / J. M. DESANTES, **MOTORES DE COMBUSTIÓN INTERNA ALTERNATIVOS**, EDITORIAL REVERTE, 2011

MARTÍN CUESTA ÁLVAREZ, **MOTORES DE REACCIÓN**, 9ª EDICIÓN, EDICIONES PARANINFO, 2001

ANTONIO ESTEBAN OÑATE, **CONOCIMIENTOS DEL AVIÓN (LIBROS II Y III)**, 7ª EDICIÓN, EDICIONES PARANINFO, 2019

A.G. VELÁZQUEZ / J.R. ARIAS / F. SASTRE, **MOTORES ALTERNATIVOS**, 3ª EDICIÓN, GARCETA GRUPO EDITORIAL, 2021

Complementary Bibliography

JACK D. MATTINGLY, **ELEMENTS OF PROPULSION: GAS TURBINES AND ROCKETS**, AIAA EDUCATION SERIES, 2006

GORDON C. OATES, **AEROTHERMODYNAMICS OF GAS TURBINE AND ROCKET PROPULSION**, AIAA EDUCATION SERIES, 1997

CLAUDIO MATAIX, **TURBOMÁQUINAS TÉRMICAS**, 3ª EDICIÓN, DOSSAT EDICIONES, 2011

BORJA GALMÉS BELMONTE, **MOTORES DE REACCIÓN Y TURBINAS DE GAS**, 2ª EDICIÓN, EDICIONES PARANINFO, 2018

ALLAN T. KIRKPATRICK, **INTERNAL COMBUSTION ENGINES APPLIED THERMOSCIENCES**, 4TH EDITION, ED. WILEY-BLACKWELL, 2020

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	Choose	Year	Quadmester
	9	Optional	3	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Randulfe López, Rodrigo Fernández González, Santiago			
Lecturers	Fernández González, Santiago Randulfe López, Rodrigo			
E-mail	santiago.fernandez.gonzalez2@uvigo.es rodrigo.randulfe.lopez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Esta materia introduce ao deseño mecánico, ao método de elementos finitos e ao estudo das vibracións mecánicas.			

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B1	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.
B2	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.
C20	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.
C22	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.
C25	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.
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D8	Capacidade de razoamento crítico e autocrítico
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados previstos na materia				
Expected results from this subject	Training and Learning Results			
Coñecemento, comprensión e aplicación de elementos mecánicos.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11

Coñecemento dos aspectos máis destacados das cualidades dos Sistemas mecánicos: modos de fallo e fiabilidade.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Capacidade para identificar e resolver problemas mecánicos.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Comprensión do método dos elementos finitos.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Resolución de problemas relativamente complexos en mecánica de medios continuos mediante a selección do modelo de comportamento e da formulación adecuada para o mesmo.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Coñecemento, comprensión, aplicación, análise e síntese dos métodos aplicados ao estudo da resposta de aeronaves fronte a cargas non estacionarias.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Coñecemento, comprensión, aplicación, análise e síntese dos sistemas vibratorios dun grao de liberdade, de múltiples graos de liberdade e continuos.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Coñecemento, comprensión, aplicación, análise e síntese dos métodos aproximados de cálculo para os sistemas continuos.	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11

Contidos	
Topic	
Deseño de sistemas mecánicos	- Introducción ao deseño mecánico. - Materiais, propiedades mecánicas, ensaios en laboratorio. - Teoría de mecanismos.
Elementos mecánicos	- Deseño de elementos mecánicos; eixes e árbores, engranaxes, rodamentos, freos, embragues, unións... - Aplicación ao campo da aeronáutica.
Modos de fallo e fiabilidade	- Teorías de fallo en deseño estático. - Teorías de fallo en deseño dinámico, fatiga. - Predición dos modos de fallo, estimación de vida dos elementos (fiabilidade).
Teoría dos elementos finitos (MEF) lineal con énfase en dinámica de sólidos deformables	- Fundamentos. - Xeometría dos elementos. - Coordenadas nodais. - Xeración de mallas.
Introdución á resolución de problemas non lineais por elementos finitos	- Ecuacións e conectividade entre elementos. - Imposición de ligaduras. - Determinación da matriz de inercia, elástica e de amortiguamento.
Xeneralidades sobre sistemas vibratorios. Modelos aplicables á análise de vibracións en aeronaves	- Introdución ás vibracións mecánicas. Tipoloxía. - Clasificación das vibracións mecánicas. - Elementos básicos na vibración; elasticidade e amortiguamento.
Sistemas dun grao de liberdade	- Obtención das ecuacións diferenciais do movemento. - Vibracións lonxitudinais e torsionais. - Vibracións libres, amortiguadas, forzadas externamente.

Sistemas de varios graos de liberdade	- Métodos de desenvolvemento e análise matemática. - Obtención das matrices de elasticidade e amortiguamento. - Resposta dos sistemas a excitacións externas.
Sistemas continuos	- Tipoloxía de vibracións mecánicas. Vibracións transversais. - Frecuencias naturais, condicións límite. - Formulación e desenvolvemento de ecuacións. - Pulsacións propias.
Métodos aproximados, vibracións autoexcitadas e vibracións non lineais.	- Excitacións non deterministas. - Propiedades estatísticas. - Correlación.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	34	70	104
Prácticas de laboratorio	20	0	20
Resolución de problemas	20	30	50
Actividades introdutorias	1	0	1
Resolución de problemas de forma autónoma	0	37	37
Informe de prácticas, prácticum e prácticas externas	0	9.5	9.5
Resolución de problemas e/ou exercicios	2	0	2
Resolución de problemas e/ou exercicios	1.5	0	1.5

*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	- Clase maxistral na que se expoñen os contidos teoricos e prácticos por medios tradicionais (encerado) e recursos multimedia.
Prácticas de laboratorio	- Realización de tarefas prácticas en laboratorio con soporte informático.
Resolución de problemas	- Actividade na que se formulan problemas e/ou exercicios relacionados coa materia.
Actividades introdutorias	- Actividades encamiñadas a tomar contacto e reunir información sobre o alumnado, así como a presentar a materia.
Resolución de problemas de forma autónoma	- Actividade na que se formulan problemas e/ou exercicios relacionados coa materia. O alumno/a debe desenvolver a análise e resolución dos problemas e/ou exercicios de forma autónoma.

Atención personalizada

Methodologies	**Description**
Lección maxistral	O profesorado axudará ao estudante a resolver de maneira individual ou colectiva as dúbidas e dificultades que atopen na comprensión dos contidos teóricos da materia. Tutorías individuais ou en grupos reducidos co profesorado da materia. Opción de realizar as tutorias de forma online.
Prácticas de laboratorio	O profesor axudará ao estudante a resolver as dificultades que poida atopar na resolución de prácticas a realizar en laboratorio (con computador). Tutorías individuais ou en grupos reducidos co profesorado da materia. Opción de realizar as tutorias online.
Resolución de problemas	O profesor axudará ao estudante a resolver as dificultades que poida atopar na resolución de ejercicios prácticos. Tutorías individuais ou en grupos reducidos co profesorado da materia. Opción de realizar as tutorias online.
Tests	**Description**
Informe de prácticas, prácticum e prácticas externas	O profesorado atenderá ao estudante de forma presencial ou online nas revisións a efectuar dos informes de prácticas realizadas, despexando as súas dúbidas.
Resolución de problemas e/ou exercicios	O profesorado atenderá ao estudante de forma presencial ou online nas revisións a efectuar dos problemas prantexados nos exames parciais, despexando as súas dúbidas.
Resolución de problemas e/ou exercicios	O profesorado atenderá ao estudante de forma presencial ou online nas revisións a efectuar dos problemas prantexados nos exames parciais, despexando as súas dúbidas.

Avaliación

	Description	Qualification	Training and Learning Results

Informe de prácticas, prácticum e prácticas externas	Avaliaranse os informes achegados polos estudantes da realización das prácticas en laboratorio.	20	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Resolución de problemas e/ou exercicios	Avaliaranse a resolución dos problemas realizados polos estudantes nas probas parciais durante o curso. 1º Parcial (P1).	40	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11
Resolución de problemas e/ou exercicios	Avaliaranse a resolución dos problemas realizados polos estudantes nas probas parciais durante o curso. 2º Parcial (P2)	40	A2 A3 A5	B1 B2	C20 C22 C25	D3 D4 D5 D6 D8 D11

Other comments on the Evaluation

As probas a realizar durante o curso serán as seguintes:
1.- Un parcial (P1) a realizar durante o curso en horario lectivo. Cun peso do 40% no total da Evaluación Continua (EC). Se o estudante aproba P1, a calificación obtida conservaráse no exame final da avaliación continua, na primeira ou na segunda oportunidade.
2.- Un parcial (P2) coincidindo co exame final de 1ª oportunidade (E1) establecido polo centro. Contará cun peso do 40% do total da nota de EC. Si se aproba esta parte, conservarase a nota na avaliación do exame final de 2ª oportunidade (E2).
3.- A entrega obligatoria das Memorias (M) asociadas as prácticas. Cun peso do 20% do total da EC, memorias a realizar en horas non presenciais e a entregar nas últimas datas do curso. A asistencia ás prácticas non é obrigatoria pero si a entrega de tódalas memorías asociadas a elas.Se o estudante supera M, a calificación obtida conservarase no exame E1 e no exame E2.
As tres probas anteriores; P1, P2, M, compoñen as probas da EC.
4.- Un exame global de 1ª oportunidade (E1).
5.- Un exame global de 2ª oportunidade (E2).
A asinatura poderase aprobar/superar dalgunha das seguintes formas:
1.- O estudantado que queira aprobar na modalidade de EC deberá ter aprobada cada unha das probas que a compoñen; P1+P2+M.
Sen menoscabo do anterior, os estudantes que queiran mellorar nota poderán presentarse de forma voluntaria os exames globais (E1/E2) sendo evaluados pola maior das notas obtidas entre a EC e E1/E2.
2.- Os estudantes que non se atopen no anterior punto, poderán supera-la asinatura presentándose ós exames globais establecidos oficialmente polo centro (E1/E2).
O estudante ten dereito a optar pola evaluación global; sendo así o alumno terá que superar un exame global dividido en 2 partes que coincidirán cos parciais que formaron a EC (P1 y P2).
Exame fin de grao.O estudante que se presente ó exame fin de carreira será avaliado ó completo ca nota obtida en dito exame.
Nota: Considerarase que calqueira das probas anteriormente descritas están aprobadas cando o estudante obteña unha nota igual ou superior a 5 ptos.
A duración máxima do exame será de 4 horas si se fai de forma continua ou de 5 horas si hai unha pausa intermedia (neste caso a duración máxima de cada parte non superará as 2,5 horas).

O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro dá EEAE publícase na web http://aero.uvigo.es/gl/docencia/exames.
Compromiso ético:

Esperase que o estudante presente un comportamiento ético adecuado. No caso de detectar un comportamiento non ético (copia, plaxio, utilización de aparatos electrónicos non autorizados, e outros) considerarase que o estudante non reúne os requisitos necesarios para superar a materia. Neste caso a calificación global no presente curso académico será de suspenso (0).

Bibliografía. Fontes de información

Basic Bibliography

Shigley, **Diseño en ingeniería mecánica**, Octava, McGrawHill, 2008
Singeresu S. Rao, **Vibraciones mecánicas**, Quinta, Pearson, 2012

Complementary Bibliography

A.S.Hall, A.R. Holowenco, H.R.Laughlin, **Diseño mecánico, teoría y 320 Problemas resueltos**, Serie Schaum,
William W. Seto, **Vibraciones mecánicas, teoría y 225 problemas resueltos**, Serie Schaum,
Justo Nieto, **Síntesis de mecanismos**, Editorial AC,

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
Resistencia de materiais e elasticidade/O07G410V01405

IDENTIFYING DATA				
Space vehicles				
Subject	Space vehicles			
Code	O07G410V01933			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Gómez San Juan, Alejandro Manuel			
Lecturers	Gómez San Juan, Alejandro Manuel Ulloa Sande, Carlos			
E-mail	alejandromanuel.gomez@uvigo.es			
Web	http://aero.uvigo.es			
General description	The Spacecraft course examines vehicles operating in an environment radically different from that on Earth. Understanding this environment is essential when defining the design requirements for spacecraft. In this subject, students will study not only the space environment itself but also the orbital mechanics concepts required to understand the principal orbits, maneuvers, and the main perturbations affecting spacecraft. The course covers the principal subsystems of a spacecraft, with particular emphasis on the thermal control subsystem and the attitude control subsystem. Laboratory work includes hands-on exercises using specialized hardware and mission-analysis simulation software. English-Friendly Option: International students may request from the teaching staff: Course materials and bibliographic references in English; Office hours conducted in English; Examinations and assessments in English			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Capability 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.
B6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
C24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D6	Capabiliity for interpersonal communication
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Knowledge, understanding, application and analysis of the basic configurations, subsystems and missions of spacecraft	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Ability to analyse the mission profile, the type of guidance law and the space trajectory.	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Knowledge, understanding, application and analysis of spacecraft thermal-control systems.	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Knowledge, understanding, application and analysis of spacecraft attitude and orbit control.	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Knowledge and understanding of spacecraft test systems and ground-support infrastructure	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13

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. Lesson 2.2: The two-body problem. Time laws and orbital elements. Lesson 2.3: Tracks, 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: Rendezvous 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, command 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	6	18
Seminars	0	2	2
Previous studies	0	79.5	79.5
Mentored work	10	10	20
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
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
Mentored work	Mentored work

Personalized assistance

Methodologies	Description
Seminars	Small group tutoring with the teachers of the subject. The tutorials will be held, by appointment, in the theacher's office or in the teacher's virtual office, on the Remote Campus.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Laboratory report	10	A2 A3 A5	B1 B6	C24	D3 D4 D11 D13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	A2 A3 A5	B1 B6	C24	D3 D4 D6 D11 D13
Objective questions exam	Partial examination of short questions and problems (30%) (Percentage can be divided into shorter tests) Final examination of short questions and problems (40%)	70	A2 A3 A5	B1 B6	C24	D3 D4 D11 D13

Other comments on the Evaluation

First Call:

(1) Students who follow the course by Continuous Assessment:

In order to pass the subject at the first opportunity, through Continuous Assessment, it will be necessary:

-A grade in the Continuous Assessment final exam of at least 5.0.

-Attend at least 80% of the practical sessions.

-Submit all the practical reports and assignments for the subject, obtaining at least a grade of 3 in each of them.

In the case of not meeting these conditions, the final mark will be the result of the minimum of the average mark of EC and 4.9.

Continuous assessment tests will be carried out during school hours, whenever possible. The final Continuous Assessment exam will be held on the date approved by the center for the first call.

(2) Students who wish to be evaluated by exam-only assessment:

The evaluation of the course at the first call will be carried out, by default, through Continuous Assessment. The student body has the right to opt for the exam-only assessment according to the procedure and the period established by the center for each call, which may not exceed one month.

The grade obtained in this exam will represent 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may have a part to be taken in a computer room and/or laboratory, and will include all of the material taught, as well as the content covered in all the practical sessions and assignments.

The exam-only assessment exam will be carried out on the date approved by the center for the first call.

Second call and end-of-program call:

Students who have not passed the subject at the first call and have waived the continuous assessment, may take an exam only assessment exam that will account for 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may have a part to be taken in a computer room and / or laboratory, and will cover the entire subject taught, as well as the contents covered in all practical sessions and assignments. The student who has been evaluated by

continuous assessment at the first call and has not waived it, will be re-evaluated for the final exam of Continuous Assessment.

The second call and end of degree exams will be held on the dates approved by the center for each call.

Other considerations:

In case of detection of plagiarism in any qualification element, the qualification in said item will be 0 and the fact will be communicated to the direction of the Center for the appropriate effects.

The evaluation test schedule officially approved by the Board of the EEAE Center is published on the website http://aero.uvigo.es/es/docencia/examenes

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				
Aeronaves de á fixa e rotatoria				
Subject	Aeronaves de á fixa e rotatoria			
Code	O07G410V01934			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Rey González, Guillermo David			
Lecturers	Rey González, Guillermo David			
E-mail	guillermo.rey@uvigo.es			
Web	http://aero.uvigo.es			
General description	Deseño de aeronaves de á fixa e rotatoria, coas súas tipoloxías, métodos de cálculo, estabilidade, control e sistemas.			

Resultados de Formación e Aprendizaxe	
Code	
A1	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
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B1	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.
B3	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.
C17	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.
C24	Coñecemento adecuado e aplicado á Enxeñaría de: Os sistemas das aeronaves e os sistemas automáticos de control de voo dos vehículos aeroespaciais.
C25	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.
C26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.
D1	Capacidade de análise, organización e planificación
D2	Liderado, iniciativa e espírito emprendedor
D3	Capacidade de comunicación oral e escrita na lingua nativa
D4	Capacidade de aprendizaxe autónoma e xestión da información
D5	Capacidade de resolución de problemas e toma de decisións
D6	Capacidade de comunicación interpersoal
D7	Capacidade de adaptación a novas situacións con creatividade e innovación
D8	Capacidade de razoamento crítico e autocrítico
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Coñecemento, comprensión, aplicación, análise e síntese dos métodos de cálculo de deseño e proxecto de aeronaves de á fixa	A1 A2 A3 A5	B1 B3	C24 C25 C26	D3 D4 D6 D8
Coñecemento dos aspectos máis destacados das calidades de voo e os ensaios en voo das aeronaves de ás rotatorias	A2 A3 A5	B2 B3	C17 C24 C25 C26	D1 D2 D3 D4 D5 D6 D7 D8 D11

Contidos	
Topic	
Tema 1. Tipos de aeronaves de á fixa e rotatoria	Tema 1.1. Aeronaves de á fixa Tema 1.2. Aeronaves de á rotatoria
Tema 2. Introdución ás aeronaves de ás rotatorias	
Tema 3. Aerodinámica de rotores.	Tema 3.1. Voo axial Tema 3.2. Voo en avance
Tema 4. Actuacións de aeronaves de ás rotatorias	
Tema 5. Introdución á estabilidade e controlabilidad das aeronaves de ás rotatorias	
Tema 6. Introdución ás Calidades de Voo e aos Ensaios en Voo das aeronaves de ás rotatorias	
Tema 7. Métodos de deseño preliminar de aeronaves de á fixa e rotatoria	
Tema 8. Arquitectura e deseño de compoñentes de aeronaves de á fixa	Tema 8.1. Fuselaxes Tema 8.2. Ás Tema 8.3. Superficies estabilizadoras Tema 8.4. Trens de aterraxe
Tema 9. Sistemas de aeronaves de á fixa	

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	68	98
Aprendizaxe baseado en proxectos	30	60	90
Resolución de problemas	8	8	16
Prácticas de laboratorio	7	10.5	17.5
Presentación	0.5	0	0.5
Exame de preguntas obxectivas	3	0	3

*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/a dos contidos sobre a materia obxecto de estudo, bases teóricas e/ou directrices dun traballo, exercicio que o/a estudante ten que desenvolver.
Aprendizaxe baseado en proxectos	O/A estudante, de maneira individual ou en grupo, elabora un documento sobre a temática da materia ou prepara seminarios, investigacións, memorias, ensaios, resumos de lecturas, conferencias etc.
Resolución de problemas	Actividade na que se formulan problema e/ou exercicios relacionados coa materia. O alumno debe desenvolver as solucións axeitadas ou correctas mediante a exercitación de rutinas, a aplicación de fórmulas ou algoritmos, a aplicación de procedementos de transformación da información dispoñible e a interpretación dos resultados. Adóitase empregar como complemento da lección maxistral.
Prácticas de laboratorio	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedementais relacionadas coa materia obxecto de estudo. Desenvólvense en espazos especiais con equipamento especializado (Laboratorios, aulas informáticas, etc...)

Atención personalizada	
Methodologies	**Description**

Lección maxistral	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades para realizar en grupo, ou simplemente para informar o docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.
Aprendizaxe baseado en proxectos	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades para realizar en grupo, ou simplemente para informar o docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.
Prácticas de laboratorio	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades para realizar en grupo, ou simplemente para informar o docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.
Resolución de problemas	No ámbito da acción titorial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o alumnado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades para realizar en grupo, ou simplemente para informar o docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.

Avaliación

	Description	Qualification	Training and Learning Results		
Aprendizaxe baseado en proxectos	Realización dun proxecto de deseño de aeronave de á fixa ou rotatoria.	20	A2 A3 A5	C24 C25 C26	D3 D4 D6 D8 D11
Prácticas de laboratorio	Resolución de problemas e casos prácticas expostos nas sesións de prácticas.	20	A2 A3 A5	C24 C25 C26	D3 D4 D8
Presentación	Presentación en clase do traballo grupal desenvolvido.	20	A2 A3 A5	C24 C25 C26	D3 D4 D6
Exame de preguntas obxectivas	Exame de problemas e/o preguntas de desenvolvemento e/o tipo test	40	A2 A3 A5	C24 C25 C26	D3 D4 D8

Other comments on the Evaluation

O calendario de probas de avaliación atópase publicado na páxina Web do centro.

Primeira oportunidade.

(1) Estudantes que seguen o curso por Avaliación Continua.

Para poder superar a materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, no exame final de avaliación continua de, como mínimo, un 4.0.

-Asistir a, como mínimo, o 90% das sesións de prácticas.

-Entregar a totalidade de memorias prácticas e traballos da materia obtendo, como mínimo, unha nota de 3 en cada un deles.

No caso de non cumprir ditas condicións a nota final será a resultante do mínimo da nota media ponderada de AC e de 4.9.

(2) Estudante que desexen ser avaliados mediante avaliación global.

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua. O estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

A nota obtida neste exame representará o 100% da nota final. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados en todas as sesións prácticas e traballos.

Segunda oportunidade e Fin de Carrera.

O estudantado que non superase a materia na primeira oportunidade poderá realizarán un exame que supoñerá o 100% da nota. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados en todas as sesións prácticas e traballos.

En caso de detección de plaxio en calquera elemento de cualificación, a cualificación na devandita entrega será 0 e o feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

Álvaro Cuerva Tejero, **Teoría de los Helicópteros**, 978-84-1545-221-8, 2, Ibergaceta Publicaciones, 2012

Raymond W. Prouty, **Helicopter Performance Stability and Control**, 978-0894649295, Revised edición, Krieger Publishing Company, 1995

Daniel P. Raymer, **Aircraft Design: A conceptual approach**, 978-1-62410-490-9, 6, American Institute of Aeronautics and Astronautics, 2020

Complementary Bibliography

J. Gordon Leishman, **Principles of Helicopter Aerodynamics**, 978-1107013353, 2, Cambridge University Press, 2016

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,

Recomendacións

Subjects that are recommended to be taken simultaneously

Mecánica do voo/O07G410V01924

Subjects that it is recommended to have taken before

Aerodinámica e aeroelasticidade/O07G410V01923

IDENTIFYING DATA				
Maintenance and certification of aerospace vehicles				
Subject	Maintenance and certification of aerospace vehicles			
Code	O07G410V01935			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	García Luis, Uxía			
Lecturers	García Luis, Uxía			
E-mail	uxia.garcia.luis@uvigo.gal			
Web	http://aero.uvigo.es			
General description	Airworthiness refers to an aircraft's ability to fly. This quality is ensured through certification, which is consists of a series of tasks designedtasks designed to guarantee that the aircraft is in safe condition for flight. To maintain these conditions over time, we refer to continuing airworthiness, which involves all the necessary inspections, modifications and maintenance tasks to preserve airworthiness. This course covers the procedures related to airworthiness, with a focus on analyzing 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B3	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.
B4	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.
C21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.
C25	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.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	
Expected results from this subject	Training and Learning Results

- Knowledge, understanding, application, analysis and synthesis of aircraft certification and maintenance methods.	A2 A3 A5	B3 B4	C21 C25	D3 D4 D5 D6 D8 D11 D13
- Applied knowledge of simulation, design, analysis and synthesis of experimentation and flight operations.	A2 A3 A5	B3 B4	C21 C25	D3 D4 D5 D6 D8 D11 D13

Contents

Topic	
Block 1: Certification	Unit 1.1: Introduction and concepts Unit 1.2: Organizations responsible for airworthiness Unit 1.3: Airworthiness requirements Unit 1.4: The type certificate. The TC process. Unit 1.5: Production of articles, pieces and devices. Unit 1.6: Certificates of airworthiness Unit 1.7: Aircraft and operations certification codes Unit 1.8: Modification of aircraft Unit 1.9: Validation and tests of space vehicles
Block 2: Maintenance	Unit 2.1: Fundamentals of aeronautical maintenance Unit 2.2: Continuing airworthiness Unit 2.3: Management and types of maintenance Unit 2.4: Quality assurance and maintenance safety

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	33	0	33
Laboratory practical	20	10	30
Seminars	2	0	2
Previous studies	0	126.5	126.5
Mentored work	20	10	30
Objective questions exam	3.5	0	3.5

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

Methodologies

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

Personalized assistance

Methodologies	Description
Seminars	Small group tutoring with the teachers of the subject. The tutorials will be held, by appointment, in the the instructor's office or in the instructor's virtual office, on the Campus Remoto platform.

Assessment

	Description	Qualification	Training and Learning Results

Laboratory practical	Laboratory report	10	A2 A3 A5	B3 B4	C21 C25	D3 D4 D5 D6 D8 D11 D13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	A2 A3	B3 B4	C21 C25	D3 D4 D5 D6 D8 D11 D13
Objective questions exam	Partial exam Certification of short questions and problems (35%)* Partial Maintenance Exam consisting of short questions and problems (35%)* * If a student fails any of the partial exams, they must be repeated on the date of the final exam.	70	A2 A3 A5	B3 B4	C21 C25	D3 D4 D5 D8 D11 D13

Other comments on the Evaluation

First Call:

(1) Students who follow the course by Continuous Assessment:

In order to pass the subject at the first exam call, through Continuous Assessment, it will be necessary:

-A grade in each of the Continuous Assessment partial exams (Certification and Maintenance) of at least 4.0.

-Attendance of at least 80% of the practical sessions.

-Submission of all the practical reports and assignments for the subject, obtaining at least a grade of 3 in each of them.

If these conditions are not met, the final mark will be the result of the minimum of the average mark of EC and 4.9.

Continuous assessment tests will be carried out during school hours, whenever possible. The final Continuous Assessment exam will be held on the date approved by the center for the first exam call.

(2) Students who wish to be evaluated by exam-onlyassessment:

The evaluation of the course at the first exam call will be carried out, by default, through Continuous Assessment. Students have the right to opt for the exam-only assessment according to the procedure and the period established by the center for each exam call, which may not exceed one month.

The grade obtained in this exam will represent 100% of the final grade. The student must obtain a minimum grade of 5.0 on this exam. This exam may include a portion that is taken in a computer room and/or laboratory, and will include all of the material taught, as well as the content covered in all the practical sessions and assignments.

The exam-only assessment exam will be carried out on the date approved by the center for the first exam call. Second exam call and end-of-program exam call:

Students who have not passed the subject at the first exam call and have waived the continuous assessment, may take an exam only assessment exam that will account for 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may include a portion that is taken in a computer room and / or laboratory, and will cover the entire subject taught, as well as the contents covered in all practical sessions and assignments. The student who has been evaluated by continuous assessment at the first exam call and has not waived it, will be re-evaluated for the final exam of Continuous Assessment.

The second exam call and end-of-program exams will be held on the dates approved by the center for each exam call. Other considerations:

In the event that plagiarism is detected in any assessment component, a score of 0 will be assigned to that component, and the incident will be reported to the department for appropriate action.

The evaluation test schedule officially approved by the Board of the EEAE Center is published on the website

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**,

FAA, **Regulaciones Federales de Aviación de la FAA (EE.UU.)**,

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	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@dma.uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this course is for students understand and master different techniques and methods necessary for other subjects as well as for professional practice. The course covers the main numerical methods for solving large linear and non-linear systems, initial value and boundary 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
C32	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.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results			
LO1: Knowledge, understanding and application of numerical methods for solving typical Aerospace Technology models and problems.	A2 A3 A5	B2	C32	D3 D4 D5 D6 D8 D11
LO2: Know and use a numerical simulation software tool that uses the finite element method.	A2 A3 A5	B2	C32	D3 D4 D5 D6 D8 D11

Contents	
Topic	
Numerical resolution of large linear systems and non-linear systems	1. Direct methods 2. iterative methods. 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	1	0	1
Lecturing	25	60	85
Problem solving	6	12	18
Autonomous problem solving	0	13.5	13.5
Practices through ICT	18	12	30
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 aimed at engaging with and gathering information about the students, as well as introducing the course content.
Lecturing	In the theoretical classes, the professor will present the course content illustrating theoretical concepts with numerous examples and applications. The students will have basic reference texts to support their understanding of the material.
Problem solving	Approach, analyze, solve, and discuss a problem or exercise related to the material, both by the instructor and the students. This serves to illustrate and complement the explanation of each lesson and helps the students acquire the necessary skills.
Autonomous problem solving	Students will have to do exercises similar to those done in class in order to acquire the necessary skills.
Practices through ICT	They will use computer tools to solve problems and exercises, applying the knowledge gained in the theoretical classes. Students will also need to solve similar exercises to acquire the necessary skills..

Personalized assistance	
Methodologies	**Description**
Problem solving	The professor will personally address student's questions. These will be done face-to-face, especially during problem-solving classes, laboratory sessions, and tutorials. Non-face-to-face queries will be handled through the available online systems for the course.
Lecturing	The professor personally address student's questions. These will be done face-to-face, especially during problem-solving classes, laboratory sessions, and tutorials. Non-face-to-face queries will be handled through the available online systems for the course.
Autonomous problem solving	The professor personally address student's questions. These will be done face-to-face, especially during problem-solving classes, laboratory sessions, and tutorials. Non-face-to-face queries will be handled through the available online systems for the course.

Assessment		
Description	Qualification	Training and Learning Results

Problem solving	There will be a written test for each part of the course to evaluate the independent resolution of exercises and/or problems. Each test will have a weight of 20%. LO1	40	A2 A3 A5	B2	C32	D3 D4 D5 D6 D8 D11
Practices through ICT	Assistance and correct realisation of the practical exercises using computer programs. LO1, LO2	20	A3 A5	B2	C32	D4 D5 D8
Essay questions exam	Completion of a final exam covering the content from the lectures and problem soloving sessions. LO1	40	A2 A3 A5	B2	C32	D3 D4 D5 D6 D8 D11

Other comments on the Evaluation

The preferred mode of assessment is continuous assessment. The student has the right to opt for the overall assessment (100% of the grade on the official date) according to the procedure and deadline established by the centre for each exam call.

In any exam call it is necessary to obtain 5 points to pass the course. To pass the course, it is necessary to complete the laboratory practices, achieve a score of 5 out of 10 in them, and obtain a 5 out of 10 on the final exam. If the minimum score is not reached in any of these parts, the final grade on the transcript will reflect the corresponding score, capped at a maximum of 4.8 points.". (*)

The maximum duration of any exam will be 3 hours.

Second call evaluation:

Students will take an exam assessing the learning outcomes and competencies outlined in the teaching guide. A score of 5 out of 10 must be achieved, and the exam will contribute 80% to the final grade. The criteria indicated in (*) will also apply.

If the student does not achieve a 5 out of 10 in the laboratory practicals, he/she will have to take an additional test to pass this part, which represents 20% of the final grade.

Exam-only assesment procedure (any exam call):

The end-of-degree exam call follows the global assessment procedure.

Theoretical and practical assessment: An exam will assess the learning outcomes and the competencies listed in the instructor's guide. Students must achieve a score of 5 out of 10, contributing 80% to the final mark.

Practical evaluation of computer exercises: Completing this test is mandatory to pass the course. It will consist of a practical exam covering the topics addressed in the computer sessions throughout the course. A score of 5 out of 10 must be obtained for it to be combined with the theoretical part, contributing 20% to the final grade.

The criteria indicated in (*) will also apply.

Evaluation dates:

The evaluation schedule officially approved by the EEAE is published on the website http://aero.uvigo.es/es/docencia/examenes/

Ethical commitment:

Students are expected to demonstrate appropriate ethical behavior. If unethical behavior is detected (such as copying, plagiarism, unauthorized use of electronic devices, etc.), the student will be deemed not to meet the necessary requirements to pass the course. In such cases, the final grade for the academic year will be recorded as a failing grade (0.0).

Please be reminded of the prohibition of the use of mobile devices or laptops during exercises and practical sessions. According to Royal decree 1791/2010, of December 30, which approves the Statute of the University Student, Article 13.2.d), specifies the duties of university students, including the obligation to:

"Abstain from using or cooperating in fraudulent activities during exams, assignments or on official university documents".

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 Multiphysics**, 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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Álvarez González, David			
Lecturers	Álvarez González, David Pintos Alonso, Aránzazu			
E-mail	davidag@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	This course has to be considered as the continuation of Materials Science and Technology 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. Some of the methods used to join materials as well as those used for tensting will be also addressed. English Friendly course: 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C30	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.
C32	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.
C33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results		
Knowledge, understanding and application of the materials employed in the aerospace sector: capacity to identify his differences.	A3	C30 C33	D4 D8 D11 D13
Knowledge, understanding and application of the materials used in the aerospace sector: tools for the determination of the behaviour and properties.	A3 A5	C32 C33	D4 D5 D6 D8 D11

Knowledge, understanding and application of the materials employed in the aerospace sector: methods of manufacture and optimización.	A2 A3 A5	C32 C33	D3 D4 D5 D6 D11 D13

Contents	
Topic	
Lesson 1.- General characteristics of materials used in the aerospace industry	Design requirements, accreditation and certification of evolution two materiais
Lesson 2.- Light alloys: Aluminium alloys. Magensium and Berilium alloys	Aluminium alloys: Processing and heat treatments. Classification. Main aluminium alloys for aerospace applications. Magnesium alloys for aerospace applications. Berilium alloy.Main aerospace applications
Lesson 3.- Ultra high strength steels	High resistance stelels: quench and tempering steels. PH Steels. Stainless steels. UHS steels. Maraging. Steels.
Lesson 4.- Titanium Alloys	Introduction to titanium alloys: physical metallurgy and processsing. Properties of titanium 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. Metal matrix composites
Lesson 6.- Polymer Matrix Composites	General characteristics. Fibers and Matrix: carbon fibers. Ceramic Fibers (glass, Boron). Organic fibers (aramide, polyethilene), Metallic fibers. Resins (epoxi, poyester, fenolic). Prepregs. Sandwich cores. Thermoplastic matrix. Fibre Metal Laminate (FML) Manufacturing processes. Structural adhesives.
Lesson 7.- Ceramic materials for aerospace	General characteristics. UHT ceramics. Borides, carbides, nitrides. Applications (TBC's, propulsion systems, heatshields). Ceramic matrix composites
Lesson 8.- Materials Selection	Introduction to the material selection process. Ashby method (CES Edupack). Material selection maps.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	46	115.5	161.5
Mentored work	1	20	21
Studies excursion	8	0	8
Laboratory practical	14	2	16
Problem solving	5	5	10
Objective questions exam	2	0	2
Presentation	0.5	3	3.5
Portfolio / dossier	1	1	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	Course presentation. Description of the teaching and evaluation methods. Presentation of the course contents and groups designation.
Lecturing	Teacher explains, clarifies and organizes the main concepts of the lesson, formulating and answering questions, motivating students for further study. Knowledge/skills across the course will be done . 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
Mentored work	Students will develop a work in small groups, selecting the topic among those proposed by the teacher. This activity will be evaluated through the public defense of work, using previously known criteria
Studies excursion	Visits in small group made to any of the companies in the aeronautical sector. If visits are not possible, they will be replaced by lectures given by specialists in the sector. The students must present a report of the visit made that will be included in their dossier
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. They will be evaluated through the autonomous resolution of proposed exercises that will be incorporated into the student's dossier

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.
Laboratory practical	Individual attention to the students to help them to solve the difficulties in the development of laboratory classes
Problem solving	Time in which the teacher helps the student to solve the difficulties that can be found in solving problems and practical exercises
Mentored work	Individual attention for helping students to develope the group work

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	Throughout the course, students will carry out a series of small projects or questionnaires in which, through multiple choice questions and solving exercises, they must show their understanding of the basic concepts and their rapid application to problems related to the aeronautical materials	10	A2 A5	C30	D4 D8
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	40	A2 A3	C32	D4 D8
Presentation	Oral exam in which the students present to the teachers and the classmates the work developed in small groups Students shuld demonstrate the acquired knowledge and its communication abiliity. They must answer the questions by the teahcer and the rest of the students. the evaluation will follow previously known criteria	30	A2 A3 A5		D4 D5 D8 D11 D13
Portfolio / dossier	In the portfolio, a compilation is done of the reports or the answer to the questions related to the laboratory practices done, as well as the summary visits to the selected companies. The quality of the information, clarity of exposition and adjustment of the regulations, if applicable, will be assessed.	20	A3 A5	C32 C33	D5 D8 D11 D13

Other comments on the Evaluation

The complete evaluation of the learning process and the skills developed by the student will be carried out through continuous assessment and a final written exam.

*-**Continuous assessment**: Weighing 60% of the total grade, will consist of activities performed throughout the entire semester (Problem solving: 10%; Individual or group work: 30%; Portfolio: 20%).Face-to-face presentation will be held during school hours*

*- The **written exam** (40%) consists of objective questions, short questions, and test questions. It will be held on the dates set in the evaluation alendar officially approved by the EEAE staff. It is published on the website http://aero.uvigo.eres/gl/docencia/excursos.*

To pass the course, it will be necessary to achieve a minimum grade of 30% in each one of the assessment types. If this criterion is not reached, the maximum grade that the student can achieve is a 4/10.

Students can renounce the qualification obtained in continuous assessment and take an exam that validates all of the competencies, with a 100% score. This decision to renounce continuous assessment must be communicated in the form and within the established period to the center and/or the teaching staff of the subject.

***Second call exam** (June / July) the student who regularly attends the course, and has passed the continuous assessment, will be able to choose between maintaining the grade obtained in these tests and taking only the written exam with a value 40%, or renouncing to the the continuous assessment mark and take an exam that evaluate all the skills, with 100% of the score. This decision must be communicated in the period established by the School or by the teaching staff of th course. The same nethodology will be applied in the end of program call.*

The student has the right to opt for the exam -only assesment according to the procedure and the deadline established by

the centre for each call.

***Ethical conduct**: As members of the University of Vigo, students are expected to promote an ethical culture and academic integrity. Any attempt to obtain an academic advantage by dishonest or unfair means is considered to be a lack of integrity that is unacceptable.*

In the event the teacher detects unethical behavior by a student (cheating or copy in the written exam through any method, use of electronic devices if not expressly authorized, plagiarism, recycling/resubmitting work...) the student will be graded with FAIL (0,0) in the final grade. I this behaviour is repeated, the facts will be referred to the EEAE director for his consideration.

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

Prasad, N.E.; Wanhill, R.J.H., Editors, **Aerospace Materials and Material Tecnologies, vo:1,2**, 1ª, Springer, 2017

Daniel Gay, **Composite Materials**, 3ª, CRC Press, 2015

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

Peter Morgan, **Carbon fibers and their composites**, 1ª, Taylor &Francis, 2005

Recommendations

Subjects that continue the syllabus

Materials for the aerospace industry/O07G410V01903

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

Other comments

In the event of inconsistency or discrepancy between the different linguistic versions of this publication, the Galician language version shall prevail

IDENTIFYING DATA				
Analytic and orbital mechanics				
Subject	Analytic and orbital mechanics			
Code	O07G410V01943			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Tommasini , Daniele			
Lecturers	Tommasini , Daniele			
E-mail	daniele@uvigo.es			
Web	http://http://aero.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. 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
C24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
C26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
C33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Expected results from this subject	Training and Learning Results			
Knowledge, understanding, application, analysis and synthesis of methods and techniques of Analytical Mechanics; specifically, of Lagrange and Hamilton-Jacobi equations, canonical transformations, and equilibrium, stability and oscillations of dynamical systems with N degrees of freedom.	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11
Knowledge and understanding of the dynamics of attitude of the space vehicles	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11

Knowledge, understanding, application, analysis and synthesis of the problems of astrodynamics related with the movement of the centre of masses of a spacecraft; namely, the Keplerian orbits, and the real orbits as conditioned by the different perturbations, the osculating orbits and the usual numerical methods in astrodynamics.	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11

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
Practices through ICT	12	18	30
Lecturing	26	39	65
Essay questions exam	1.25	0	1.25
Report of practices, practicum and external practices	0	22.5	22.5
Essay questions exam	1.25	0	1.25

*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
Practices through ICT	The students will numerically solve orbital mechanics problems in the computer lab under the supervision of the teacher.
Lecturing	The teacher will present the theory in lecture-style classes.

Personalized assistance	
Methodologies	**Description**
Problem solving	The student will participate in the process of solving problems under the supervision of the teacher.
Practices through ICT	The student will take part in the resolution of numerical problems with the help of the teacher
Tests	**Description**
Report of practices, practicum and external practices	The student will take part in the elaboration of the practice reports of the practices with the help of the teacher

Assessment						
	Description	Qualification	Training and Learning Results			
Problem solving	Assistance and active participation in the classes of problem solving	5	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11
Practices through ICT	Assistance and active participation in the computer practices	5	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11

Essay questions exam	First partial essay question exam	30	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11
Report of practices, practicum and external practices	Elaboration of a report describing the methodology and the results of the computer practices	30	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11
Essay questions exam	Second partial essay question exam	30	A2 A3 A5	B6	C24 C26 C33	D3 D4 D5 D6 D8 D11

Other comments on the Evaluation

The evaluations of the continuous assessment will be realized during the classes.

In continuous assessment, the final grade will be the weighted average of those obtained in the individual tests, with no minimum grade in any of the tests. The overall grade obtained with this weighted average must be equal or greater than 5 to pass the subject.

In the continuous assessment, the practices and the proofs are mandatory and liberatory. While the practices are not recoverable, the students that do not have been able to realize the first partial essay question exam-or have not passed it- will be allowed to repeat it in the day of the final examination, in which the second partial essay question exam will also be done.

The student has the right to opt for the exam-only assessment according to the procedure and the deadline established by the centre for each call. In this case, the student will be evaluated only through the exam (100% in this case).

All these criteria apply to both the first and the second call.

In the end-of-program call, the student will be evaluated only through the exam (100% in this case).

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 dates of the first partial essay question exam will be communicated at the beginning of course.

Sources of information

Basic Bibliography

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

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

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

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	García Rivera, Matías			
Lecturers	García Rivera, Matías			
E-mail	mgrivera@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This subject presents 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.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results		
RA01: The students have a global vision of the methods of optimisation and its applications, in particular in the modern technics of optimum control.	A2 A3 A5	C31	D3 D4 D5 D6 D8 D11 D13

Contents
Topic
Introduction to optimization
Discrete and sampled systems
Design of PID controllers
State-Space
State Estimation
Methods of multidimensional optimization
Linear-quadratic controller
Linear-quadratic gaussian controller
Minimum variance control
Optimization with constraints

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	24	42
Autonomous problem solving	0	24	24
Lecturing	32	44.5	76.5
Report of practices, practicum and external practices	0	5	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
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	Training and Learning Results		
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	A2 A3 A5	C31	D3 D4 D5 D6 D8 D11 D13
Report of practices, practicum and external practices	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	A2 A3 A5	C31	D3 D4 D5 D6 D8 D11 D13
Essay questions exam	This exam evaluates concepts from mainly the first part of the subjetc. Learning outcomes evaluated RA01.	30	A2 A3 A5	C31	D3 D4 D5 D6 D8 D11 D13

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 CALL

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 call, 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 CALL

For non assistant students in the first call, 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 CALL

For all students, non assistant and assistant, in the second call 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

Domínguez, S.; Campoy, P.; Sebastián, J.M.; Jiménez, A., **CONTROL EN EL ESPACIO DE ESTADO**, 9788483222973, 2a, Pearson Educación S.A., Madrid,, 2006

K. OGATA, **Ingeniería de control moderna**, 9788483226605, 5a, PRENTICE-HALL, 2010

B. C. KUO, **Sistemas de control automático**, 9789688807231, 7a, PRENTICE HALL, 1996

R. FLETCHER, **Methods of Optimization**, 9780471915478, 2e, John Wiley & Sons, 2007

Complementary Bibliography

Moreno, Garrido, Balaguer, **Ingeniería de Control: modelado y control de sistemas dinámicos**, 9788434480551, Ariel, 2003

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject covers the development challenges of propulsion systems used in aircraft and missiles. Aeronautical and space propulsion systems are required to perform a wide variety of missions, ranging from very small thrust over several years, as seen in some satellite propulsion systems, to very large thrust over a short period, such as in the thrusters of a space launcher or an intercontinental ballistic missile. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A2	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
A3	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
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
B1	Capability 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.
C29	Appropriate knowledge applied to engineering: concepts and laws that govern the internal combustion, its application to rocket propulsion.
C33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D5	Capability to solve problems and draw decisions
D6	Capabiliity for interpersonal communication
D8	Capabiliity for critical and self-critical reasoning
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Expected results from this subject	Training and Learning Results			
- To know the propulsive needs of the aircraft.	A2 A3 A5	B1	C29 C33	D3 D4 D5 D6 D8 D11 D13
- To know the thrusts and resistances related to the jet engines.	A2 A3 A5	B1	C29	D3 D4 D5 D6 D8 D11 D13

- To know and quantify in an applied way the combustion process of the jet engines and the combustion efficiency.	A2 A3 A5	B1	C29	D4 D5 D8 D11 D13
- To know how to perform an energy balance by differentiating and calculating the returns involved.	A2 A3 A5	B1	C29	D4 D5 D8 D11 D13
- 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.	A2 A3 A5	B1	C29	D4 D5 D8 D11 D13
- To know the different jet engines and know how to obtain the optimal systems from the point of view of propulsive.	A2 A3 A5	B1	C29	D3 D4 D5 D11 D13
- To size the components that intervene in the propulsive system.	A2 A3 A5	B1	C33	D4 D5 D8
- To use computer tools to calculate the performance of air-reactors.	A2 A3 A5	B1	C29	D4 D5 D8
- To know the effect of flight conditions: speed and altitude in the operation of the air-reactors.	A2 A3 A5	B1	C33	D4 D8
- To know the environmental problems of the jet engines and their possible solutions.	A2 A3 A5	B1	C29	D4 D13
- To write technical reports and make oral technical presentations related to the above.	A2 A3 A5	B1	C29 C33	D3 D6 D8 D11 D13
- To solve problems derived from the field of the subject in an autonomous way and in collaboration with others.	A2 A3 A5	B1	C29 C33	D5 D6 D8
- 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.	A2 A3	B1	C29	D4 D8
- Knowledge, understanding, application and analysis of the ideal model of the rocket engines with fluid dynamics propulsion and the influence of real effects.	A2 A3 A5	B1	C29 C33	D4 D5 D8
- Knowledge of the propellants and understanding and the combustion process of the rocket motors of solid, liquid and hybrid propellants.	A2 A3 A5	B1	C29	D4 D8
- Knowledge, understanding, application and analysis of the ionization and acceleration system of electric rocket motors.	A2 A3 A5	B1	C33	D4 D8
- Knowledge, understanding, application and analysis of the feeding and cooling systems.	A2 A3 A5	B1	C33	D4 D8
- 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.	A2 A3 A5	B1	C29 C33	D4 D5 D8

Contents	
Topic	
Block 1: Introduction	Unit 1.1: Introduction to aircraft propulsion systems. Unit 1.2: Alternative engines. Unit 1.3: Turbo-propeller and turbo-shaft.
Block 2: Rockets	Unit 2.1: Introduction Unit 2.2: Description and operating principles Unit Unit 2.3: Chemical rockets Unit 2.4: Electric propulsion

Block 3: Turbojet and turbofan	Topic 3.1: Turbojet and turbofan Engine Overview Topic 3.2: Operation of the jet engine Topic 3.3: Intake diffusers Topic 3.4: Compressors Topic 3.5: Combustion chambers Topic Topic 3.6: Turbines Topic 3.7: Nozzles Topic 3.8: Parametric analysis of turbojet and turbofan

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Laboratory practical	12	6	18
Seminars	0	2	2
Previous studies	0	79.5	79.5
Mentored work	10	10	20
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
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
Mentored work	Mentored work

Personalized assistance

Methodologies	Description
Seminars	Small group tutoring with the teachers of the subject. The tutorials will be held, by appointment, in the theacher's office or in the teacher's virtual office, on the Remote Campus.

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Laboratory report	10	A2 A3 A5	B1	C29 C33	D3 D4 D5 D6 D8 D11 D13
Mentored work	Reports and presentations of the work proposed during the course within the practical sessions	20	A2 A3 A5	B1	C29 C33	D3 D4 D5 D6 D8 D11 D13
Objective questions exam	Partial exam of short questions and problems (30%) (Percentage can be divided into shorter tests) Final exam of short questions and problems (40%)	70	A2 A3 A5	B1	C29 C33	D3 D4 D5 D8 D11 D13

Other comments on the Evaluation

First Call:

(1) Students who follow the course by Continuous Assessment:

In order to pass the subject at the first exam call, through Continuous Assessment, it will be necessary:

-A grade in the Continuous Assessment final exam of at least 4.0.

-Attendance of at least 80% of the practical sessions.

-Submission of all the practical reports and assignments for the subject, obtaining at least a grade of 3 in each of them.

If these conditions are not met, the final mark will be the result of the minimum of the average mark of EC and 4.9.

Continuous assessment tests will be carried out during school hours, whenever possible. The final Continuous Assessment exam will be held on the date approved by the center for the first exam call.

(2) Students who wish to be evaluated by exam-only assessment:

The evaluation of the course at the first exam call will be carried out, by default, through Continuous Assessment. Students have the right to opt for the exam-only assessment according to the procedure and the period established by the center for each exam call, which may not exceed one month.

The grade obtained in this exam will represent 100% of the final grade. The student must obtain a minimum grade of 5.0 on this exam. This exam may include a portion that is taken in a computer room and/or laboratory, and will include all of the material taught, as well as the content covered in all the practical sessions and assignments.

The exam-only assessment exam will be carried out on the date approved by the center for the first exam call. Second exam call and end-of-program exam call:

Students who have not passed the subject at the first exam call and have waived the continuous assessment, may take an exam only assessment exam that will account for 100% of the final grade. The student must obtain a minimum grade of 5.0 in this exam. This exam may include a portion that is taken in aa computer room and / or laboratory, and will cover the entire subject taught, as well as the contents covered in all practical sessions and assignments. The student who has been evaluated by continuous assessment at the first exam call and has not waived it, will be re-evaluated for the final exam of Continuous Assessment.

The second exam call and end-of-program exams will be held on the dates approved by the center for each exam call. Other considerations:

In the event that plagiarism is detected in any assessment component, a score of 0 will be assigned to that component, and the incident will be reported to the department for appropriate action.

The evaluation test schedule officially approved by the Board of the EEAE Center is published on the website http://aero.uvigo.es/es/docencia/examenes

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				
Vehículos aeroespaciais				
Subject	Vehículos aeroespaciais			
Code	O07G410V01946			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Rey González, Guillermo David			
Lecturers	Rey González, Guillermo David			
E-mail	guillermo.rey@uvigo.es			
Web	http://aero.uvigo.es			
General description	A materia comprende o estudo do deseño preliminar de vehículos aeroespaciais. Faise unha análise xeral dos subsistemas e profúndase nos de análises de misión, control térmico, potencia, control de orientación, e estrutural. Así mesmo faise unha introdución aos sistemas de navegación e guiado de vehículos propulsados por motor foguete.			

Resultados de Formación e Aprendizaxe	
Code	
A2	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
A3	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
A5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
B1	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.
B4	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.
B6	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.
B8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.
C4	Capacidade para comprender e aplicar os principios de coñecementos básicos da química xeral, química orgánica e inorgánica e as súas aplicacións na enxeñaría.
C6	Coñecemento adecuado do concepto de empresa, marco institucional e xurídico da empresa. Organización e xestión de empresas.
C7	Comprender o comportamento das estruturas ante as solicitacións en condicións de servizo e situacións límite.
C27	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos de sustentabilidade, mantenibilidade e operatividade dos sistemas espaciais.
C32	Coñecemento adecuado e aplicado á Enxeñaría de: Os métodos de cálculo e de desenvolvemento dos materiais e sistemas da defensa; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación numérica dos procesos físico-matemáticos máis significativos; as técnicas de inspección, de control de calidade e de detección de fallos; os métodos e técnicas de reparación máis adecuados.
C33	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.
D4	Capacidade de aprendizaxe autónoma e xestión da información
D8	Capacidade de razoamento crítico e autocrítico
D11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados previstos na materia	
Expected results from this subject	Training and Learning Results

Coñecemento, comprensión, aplicación e análise do deseño preliminar de aeronaves	A2 A3 A5	B1 B4 B6 B8	C4 C6 C7 C27 C32 C33	D4 D8 D11

Contidos

Topic	
Tema 1. Aeronaves	Tema 1.1. Deseño preliminar de aeronaves de á fixa. Tema 1.2. Deseño preliminar de aeronaves de á rotatoria
Tema 2. Mísiles	Tema 2.1. Tipos e clasificación de mísiles. Tema 2.2. Subsistemas de navegación, guiado e control de mísiles
Tema 3. Vehículos espaciais.	Tema 3.1. Tipos e clasificación de vehículos espaciais. Tema 3.2. Análise de misión. Tema 3.3. Análise xeral dos subsistemas. Tema 3.4. Subsistema de control térmico. Tema 3.5. Subsistema de control de actitude e órbita

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	24	52	76
Resolución de problemas	10	31.5	41.5
Prácticas de laboratorio	16	14	30
Exame de preguntas obxectivas	1	0	1
Exame de preguntas obxectivas	1.5	0	1.5

*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	Exposición dun tema por parte do profesorado segundo un guión previamente establecido
Resolución de problemas	Resolución de problemas e/ou exercicios que tratan aspectos puntuais dun subsistema, e que á súa vez todos xuntos abordan un problema máis global dese subsistema de vehículos aeroespaciais.
Prácticas de laboratorio	Realización de prácticas relacionadas co temario da materia. A realización das prácticas require a preparación das mesmas, a asistencia e a realización dun informe por parte do estudantado.

Atención personalizada

Methodologies	Description
Lección maxistral	No ámbito da acción titotial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o estudantado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades a realizar en grupo, ou simplemente para informar ao docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.
Resolución de problemas	No ámbito da acción titotial, distínguense accións de titoría académica, así como de titoría personalizada. No primeiro dos casos, o estudantado terá á súa disposición horas de titorías nas que pode consultar calquera dúbida relacionada cos contidos, organización e planificación da materia, co desenvolvemento do proxecto, etc. As titorías poden ser individualizadas, pero fomentaranse titorías grupais para a resolución de problemas relacionados coas actividades a realizar en grupo, ou simplemente para informar ao docente da evolución do traballo colaborativo. Nas titorías personalizadas, cada alumno, de maneira individual, poderá comentar co profesor calquera problema que lle estea impedindo realizar un seguimento adecuado da materia, co fin de atopar entre ambos algúns tipos de solución. Conxugando ambos os tipos de acción titorial, preténdense compensar os diferentes ritmos de aprendizaxe mediante a atención á diversidade.

Avaliación

Description	Qualification	Training and Learning Results

Prácticas de laboratorio	Avaliación da realización do informe.	30	A3 A5	B1 B6	C27 C32	D11
Exame de preguntas obxectivas	Exame de problemas e/o preguntas de desenvolvemento e/o tipo test	35	A2 A3 A5	B1 B6	C27 C32 C33	D4 D8 D11
Exame de preguntas obxectivas	Exame de problemas e/o preguntas de desenvolvemento e/o tipo test	35	A2 A3 A5	B1 B6	C27 C32 C33	D4 D8 D11

Other comments on the Evaluation

O calendario de probas de avaliación atópase publicado na páxina Web do centro.

Primeira oportunidade.

(1) Estudantes que seguen o curso por Avaliación Continua.

Para poder superar a materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota mínima de 4.0 en cada un dos exames.

-Asistir a, como mínimo, o 90% das sesións de prácticas.

-Entregar a totalidade de memorias prácticas e traballos da materia obtendo, como mínimo, unha nota de 3 en cada un deles.

No caso de non cumprir ditas condicións a nota final será a resultante do mínimo da nota media de AC e de 4.9.

(2) Estudante que desexen ser avaliados mediante avaliación global.

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua. O estudantado ten dereito a optar pola avaliación global segundo o procedemento e o prazo que estableza o centro para cada convocatoria.

A nota obtida neste exame representará o 100% da nota final. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados en todas as sesións prácticas e traballos.

Segunda oportunidade e Fin de Carrera.

O estudantado que non superase a materia na primeira oportunidade poderá realizarán un exame que supoñerá o 100% da nota. O estudante deberá obter unha nota mínima de 5.0 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio, e comprenderá a totalidade da materia impartida, así como os contidos abordados en todas as sesións prácticas e traballos.

En caso de detección de plaxio en calquera elemento de cualificación, a cualificación na devandita entrega será 0 e o feito será comunicado á dirección do Centro para os efectos oportunos.

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

Complementary Bibliography

Recomendacións

Subjects that are recommended to be taken simultaneously

Control e optimización/O07G410V01944

Subjects that it is recommended to have taken before

Tecnoloxía aeroespacial/O07G410V01205

Mecánica analítica e orbital/O07G410V01943

IDENTIFYING DATA				
Professional internships				
Subject	Professional internships			
Code	O07G410V01981			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
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. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A2	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
A3	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
A4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience
A5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
C19	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.
D2	Leadership, initiative and entrepreneurship
D3	Capability of oral and written communication in native lenguage
D4	Capability of autonomous learning and information management
D11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
D12	Ethical and democratic commitment

Expected results from this subject	Training and Learning Results		
Knowledge, understanding and application of work teams, oral and written communication skills at institutions of the aerospace sector	A3 A4 A5		D2 D3 D4 D11 D12
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	A2	C19	D12

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

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The students will keep in touch with the academic coordinator of the subject by sending regularly brief reports by email. In these reports, they will inform of any incidence and of the tasks developed within the company. It is recommended to send weekly reports

Assessment

	Description	Qualification	Training and Learning Results		
Practicum, External practices and clinical practices	Evaluation by the company supervisor during the development of the practices (25%) Autoevaluation of the student (25%) Evaluation of the memory of practices delivered by the student when finalising (25%) Evaluation of the report of the academic supervisor designated by the centre (25%) 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 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	A2 A3 A4 A5	C19	D2 D3 D4 D11 D12

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	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Tommasini , Daniele			
Lecturers	Tommasini , Daniele			
E-mail	daniele@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.			

Training and Learning Results

Code

Expected results from this subject

Expected results from this subject	Training and Learning Results

Contents

Topic
Knowing, understanding, application, analysis and synthesis of a project in the field of specific engineering technologies for aerospace equipment and materials.

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	Training and Learning Results
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	
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	

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 active regulations of University of Vigo and EEAE.

Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incide nt will be reported to the corresponding academic authorities for prosecution.

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.