(*)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	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Galician English			
Department				
Coordinator	Area Carracedo, Iván Carlos			
Lecturers	Area Carracedo, Iván Carlos			
E-mail	area@uvigo.gal			
Web	http://area.webs.uvigo.es			
General description	The aim of this course is that the student acquires the techniques of differential calculus both in one and several variables, and integral calculus in one variables, necessary both for other courses of the degree and for professional practice.			

Competencies

Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes

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

Contents

Topic	
Functions of one real variable.	Functions of one real variable. Limits. Continuity.
Differentiability of functions of one real variable. Mean value theorems. Limited expansions and Taylor's formula. Extrema.	Differentiability of functions of one real variable. Mean value theorems. Limited expansions and Taylor's formula. Extrema.
Integration of functions of one real variable	Primitives. Definite integral. Fundamental theorem of calculus. Geometric applications. Numerical integration
Sequences and series.	Sequences and series. Convergence. Numeric series of positive terms. Convergence criteria. Power series.

Functions of several real variables.	The n-dimensional euclidean space. Functions of several real variables. Limits. Continuity. Differentiability. Expansion and Taylor's formula. Relative extrema. Constrained optimization.

Planning

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

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

Methodologies

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

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

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

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

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

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

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

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

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

Sources of information

Basic Bibliography

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

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

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

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

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

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

Complementary Bibliography

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

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

Recommendations

Subjects that continue the syllabus

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

Subjects that are recommended to be taken simultaneously

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

Contingency plan

Description

In the event of exceptional circumstances:

Virtual teaching
The teaching activity will be carried out through Remote Campus reinforced with the use of the Moovi tele-teaching platform, without prejudice to the fact that other measures can be used to guarantee the accessibility of students to teaching content.

Tutorials
All tutoring sessions can be carried out by telematic means, either asynchronously (email, Moovi forums, etc.) or by videoconference, in this case by prior appointment.

Evaluation
The exams will be carried out in person unless otherwise indicated by the academic authorities. In any case, all the comments included in the Evaluation section remain valid.

IDENTIFYING DATA				
Mathematics: Linear algebra				
Subject	Mathematics: Linear algebra			
Code	O07G410V01102			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Galician			
Department				
Coordinator	Garcia Martinez, Xabier			
Lecturers	Garcia Martinez, Xabier			
E-mail	xabier.garcia.martinez@uvigo.gal			
Web	http://aero.uvigo.es/gl/			
General description	This subject is part of Mathematics and it is taught in the first semester of the first course. The other subjects of Mathematics are: Calculus I, in the first semester of the first course and Calculus II in the second semester of the first course. Competences of linear algebra are acquired, being a part of them fundamental for the other subjects of Mathematics. The subject has the character of basic training. It provides the mathematical basis to different disciplines in the field of the aeronautical engineering such as the calculation and manufacture of vehicles and numerical simulation. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes				
Learning outcomes	Competences			
Knowledge and understanding of the main concepts, techniques and numerical methods of Linear Algebra. Ability to apply them to other branches of Mathematics and Engineering Sciences.	CB1	CG2	CE1 CE32	CT1 CT3 CT4 CT5 CT8

Contents	
Topic	
BLOCK I	1. Real and complex numbers. 2. Systems of linear equations.
BLOCK II	3. Vector spaces. 4. Linear transformations and matrices.

BLOCK III	5. Euclidean vector spaces. 6. Diagonalisation. Orthogonal transformations.
BLOCK IV	7. Numerical methods: resolution of systems of linear equations. Computation of eigenvalues.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	18	37	55
Problem solving	29	37	66
Autonomous problem solving	2	10	12
Essay questions exam	2.5	12.5	15

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

Methodologies

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

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess			
Autonomous problem solving	The resolution of problems will be included in the partial and final exams.	30	CB1	CG2	CE1 CE32	CT3 CT4 CT5 CT8
Essay questions exam	Final exam about all the subject. Length: 2. 5 hours	70	CB1	CG2	CE1 CE32	CT3 CT4 CT5 CT8

Other comments on the Evaluation

CRITERIA OF EVALUATION FOR THE FIRST AVALIATION PERIOD

If a student no presents it any of the exams, a qualification of 0 will be assigned.

P1: Mark of the first partial (over 10); P2: Mark of the final exam (over 10).

In the case to achieve at least a 4 in the final examination, the qualification will be:

max (P2, 0.3*P1 + 0.7*P2)

In the case of not achieving a minimum a 4 in the final examination, the qualification will be:

me(4, 0.3**P1 + 0.7**P2)

CRITERIA OF EVALUATION FOR THE SECOND AVALIATION PERIOD

The final mark will be determinated by an exam about all the subject.

EXAM DATES

Continuous assessment tests will be carried out during teaching hours.

The calendar of exams officially approved by the centre will be published in the webpage
http://aero.uvigo.es/*gl/*docencia/examinations

Sources of information

Basic Bibliography

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

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

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

Recommendations

Contingency plan

Description

IF THE TEACHING IS SEMI PRESENCIAL:
Theoretical Part: The topics will be included in the Moovi platform.
Practical part: The exercises will be proposes and the students will solve them through the Moovi platform.
Assistance: Through email and Campus Remoto.
Evaluation: Presencial if possible. Otherwise online through Campus Remoto.

IF THE TEACHING IS NON-PRESENCIAL:
Theoretical Part: The topics will be included in the Moovi platform.
Practical part: The exercises will be proposes and the students will solve them through the Moovi platform.
Assistance: Through email and Campus Remoto.
Evaluation: Presencial if possible. Otherwise online through Campus Remoto.

IDENTIFYING DATA

Physics: Physics I

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

Competencies

Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE2	Understanding and mastery of the basic concepts about the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems related to engineering.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes

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

Contents

Topic	
1) Basic vectorial Calculus	- Vectors and scalars - Coordinate system

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

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	64	96
Autonomous problem solving	4	6.5	10.5
Research based methodologies	2	4	6
Programmed instruction	0	6	6
Laboratory practical	12	0	12
Essay questions exam	2.5	0	2.5
Report of practices, practicum and external practices	0	5	5
Problem and/or exercise solving	0	12	12

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

Methodologies

	Description
Lecturing	The theory of the course will be presented and it will be applied to solve problems
Autonomous problem solving	The student should solve exercises following some instructions.
Research based methodologies	Improves information processing in specific domains by using scientific research activities.
Programmed instruction	It consists of the presentation of a matter divided into several teaching units, of smaller size, with issues at the end of each teaching unit in order to strengthen the acquired knowledge. These activities can be performed 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 tasks in the laboratory, a personal follow-up will be carried out to guide the students to achieve the objectives
Research based methodologies	Tutoring sessions will be scheduled to solve any doubt of the students

Assessment

	Description	Qualification	Evaluated Competencess			
Research based methodologies	Students will present the results of their research. The maximum marks of this part will be 10% of the final total marks. (Optional)	10				CT3 CT4 CT6
Laboratory practical	In order to pass the course, laboratory tasks should be carried out. Continuous assessment will be used during the realisation of the tasks. The maximum marks of this part will be 15% of the final total marks. (Mandatory)	15	CB1		CE2	CT1 CT3 CT4 CT6 CT8
Essay questions exam	There will be an exam that include questions and exercises. The maximum marks of this part will be 60% of the final total marks. However, a minimum of 5 over 10 has to be reached in the exam to pass the course. (Mandatory)	60		CG2	CE2	CT4 CT5
Problem and/or exercise solving	The maximum marks of this part will be 15% of the final total marks. (Optional)	15			CE2	CT6

Other comments on the Evaluation

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

Dates of evaluation:
the official dates can be found in
http : //aero.uvigo.es/gl/docencia/exames
Off-site students should notify the situation to the coordinator of the course. In this case the maximum marks of the exam will be 85% of the final total marks and 15% will correspond to laboratory.
In summary:
Assessment of on-site students:
- Exam up to 60% (a minimum of 5 over 10 has to be reached in the exam to pass the course)
- Troubleshooting up to 15%
- Research based methodologies up to 10%
- Laboratory tasks up to 15% (mandatory)

Evaluation for students who do not choose a continuous assessment.

- Exam up to 85% (a minimum of 5 over 10 has to be reached in the exam to pass the course).
- Laboratory tasks up to 15% (mandatory)
VERY IMPORTANT:
A minimum of 5 over 10 has to be reached in the exam to pass the course. In the case that the mark of 5 (over 10) is not reached in the exam, the mark that will appear in the record will be the mark of that exam. The duration of the exam will be approximately 2.5 hours.
Off-site students that do not pass in the first call can attend the assessment in second call by solving one unique exam with questions regarding all contents of the course (whenever they have done the laboratory practices)

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

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

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

Contingency plan

Description

The laboratory of physics in modality mist will include face-to-face work in the laboratory and work out of the laboratory covering the total of hours of work of the student defined initially.
Some sessions of the laboratory will substitute by individual exercise owners. That is to say, the professor employing the use of Remote Campus will send all the necessary instructions to explain how to make several practices of physics at home. These instructions will include a list detailed of the material (that it can find home-like spherical objects, rope, chronometer of the mobile, meter or metric strip, etc.) and all the steps for the taking of data, as well as clear indications of the calculations that have to make and how to have to express the final results with his uncertainties.
The number of sessions of the laboratory that will substitute by these home-made practices will have to determine to take into account the norms of security imposed at this moment (distances of security, maximum capacity of people in the laboratories, etc) and the number of students by group (HC).
The evaluation of the practices (15% of the final note) will base on the work in the laboratory and the delivery of a final memory including methodology, data, and final results.

In the case of the impossibility of realization of face-to-face proofs, these will be made through the telematic platforms of the University of Vigo.

The tutoring sessions may be carried out by telematic means (email, videoconference, forums, ...) under the pre-concerted modality.

IDENTIFYING DATA

Computer science

Subject	Computer science			
Code	O07G410V01104			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	García Lourenco, Analia María			
Lecturers	García Lourenco, Analia María			
E-mail	analia@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	In this subject, the basic computer contents and introduction to the programming for graduates in Aerospace Engineering. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies

Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CE3	Basic knowledge about use and programming of computers, operating systems, databases and software with application in engineering.
CT1	Capability of analysis, organization and planification.
CT2	Leadership, initiative and entrepreneurship
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT9	Capability to work in interdisciplinary teams

Learning outcomes

Learning outcomes	Competences		
Knowledge, comprehension and application of the basic programming techniques and their use in the resolution of numerical problems in engineering.	CB1	CE3	CT4 CT5 CT9
Knowledge, understanding and application of programming methodologies (data and basic operations, modular programming, input-output operations, etc.).	CB1	CE3	CT1 CT2 CT4 CT5 CT6 CT8 CT9
Basic knowledge about operating systems and programming languages, mainly oriented to the formulation and implementation of specific numerical methods in engineering.	CB1	CE3	CT1 CT3 CT4 CT5 CT9

Contents

Topic	
Introduction to computing	Hardware: basic components Basic concepts of software Operating systems Collaborative tools Computer security Computer networks / big data

Conceptos de programación básicos	Types of programming languages: low and high level Variables Functions Flow control Input / Output
Advanced programming concepts	Advanced data types Exceptions Object-oriented programming
Programming being oriented to numerical models used in engineering	Mathematical libraries Parallel calculation Graphical representation

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Lecturing	23	46	69
Practices through ICT	20	40	60
Laboratory practical	4.5	5.5	10
Problem solving	2	6	8
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	Presentation of the subject: objectives, competences to be acquired by the student, contents, evaluation system. Building of work groups.
Lecturing	Presentation by the teacher of the contents of the course, theoretical bases and/or guidelines of the works, exercises or projects to be developed by the student.
Practices through ICT	Resolution of exercises formulated in the practical sessions, starting with the knowledge as worked in class.
Laboratory practical	Development of programs and documents in which the students reflect the characteristics of their works carried out. The students should describe the tasks and procedures they developed, show the results and observations they carried out, as well as the analysis and processing of data.
Problem solving	Evaluation tests that include theoretical questions or theoretical exercises to solve. The students must respond to the activity formulated and apply the theoretical and practical knowledge of the subject autonomously.

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Practices through ICT	Attendance and active participation	5	CB1	CE3	CT3 CT4 CT5 CT8
Laboratory practical	Development of programs and documents in which the students reflect the characteristics of their works carried out. The students should describe the tasks and procedures they developed, show the results and observations they carried out, as well as the analysis and processing of data.	65	CB1	CE3	CT1 CT3 CT4 CT5 CT6 CT8 CT9

Problem solving	Evaluation tests that include theoretical questions or theoretical exercises to solve. The students must respond to the activity formulated and apply the theoretical and practical knowledge of the subject autonomously.	20	CB1	CE3	CT3 CT4 CT5 CT8
Essay questions exam	Evaluation tests that include activities and problems or practical exercises to solve. The students must respond to the activity formulated and apply the theoretical and practical knowledge of the subject autonomously.	10	CB1	CE3	CT3 CT4 CT5 CT8

Other comments on the Evaluation

Additional information for the evaluation:
The evaluation is the same for both editions of records, the grades corresponding to the solutions of problems and/or exercises are kept.
Non-attending students to classes can take an exam in both the first and second edition of records that covers 100% of the final grade.

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

Sources of information

Basic Bibliography

Bahit, Eugenia, **Curso Python para Principiantes**, Buenos Aires : Safe Creative, 2012
González Duque, Raúl, **Python para todos**, Creative Commons, 2008
Summerfield, Mark, **Python 3**, Anaya, 2009
Guttag, John V., **Introduction to computation and programming using Python**, MIT Press, 2013

Complementary Bibliography

Recommendations

Other comments

RECOMMENDATIONS

Guidelines for the study:
- Attend classes.
- Do the exercises in the practices.
- Review the bibliography and resources presented in class.

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria in distance learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

Alternative scenario: Non-classroom teaching

Due to the exceptional situation, given the impossibility of being able to teach in person, virtual means (enabled by the University of Vigo) will be used to teach the classes.

The practices will be delivered by the students and evaluated using the resources of the teledoaching platform available at the time.

The tutorial sessions may be carried out by telematic means (email, videoconference, rooms / classrooms / virtual offices provided by the University of Vigo).

=== ADAPTATION OF THE METHODOLOGIES ===

The teaching methodologies are kept possibly with some temporal modifications in the planning depending on the actual situation.

There will be no modifications of the contents.

The bibliography might be increased with own material (e.g., guides of work, videos, explanatory texts, resolved problems, etc.) in order to facilitate self-learning.

=== ADAPTATION OF THE EVALUATION ===

The tests are kept with the same weightings.

IDENTIFYING DATA

Expresión gráfica: Expresión gráfica

Subject	Expresión gráfica: Expresión gráfica			
Code	O07G410V01105			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Galego			
Department	Deseño na enxeñaría			
Coordinator	Pérez Vázquez, Manuel			
Lecturers	Pérez Vázquez, Manuel			
E-mail	maperez@uvigo.es			
Web	http://aero.uvigo.es/gl/			
General description	O principal obxectivo da materia é capacitar o estudantado para a xestión e utilización dos sistemas e técnicas de representación máis utilizados pola industria aeroespacial, que están baseados na xeometría, sexa esta: métrica, proxectiva, analítica, descritiva ou computacional. O coñecemento dos métodos para a creación de formas, as súas propiedades e o seu manexo nos diversos contextos de enxeñaría, tanto no plano como no espazo 3D, require unha capacidade axeitada para a análise, a síntese e a visualización (abstracción e idealización), así como do uso da linguaxe gráfica. A normalización, necesaria para unha definición completa de formas, compoñentes, obxectos, equipos ou instalacións nos proxectos, require do coñecemento das normas básicas sobre formatos, liñas, modos de representación, dimensionamento, símbolos ou especificacións xeométricas do produto (GPS) . O manexo dalgunha aplicación gráfica actual que facilite a creación en 3D e a conseguinte produción de vistas, a montaxe de compoñentes, a simulación e movemento, a interactividade entre diferentes arquivos ou o dimensionamento paramétrico, enche este enfoque.			

Competencias

Code	
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
CE5	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.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

Resultados de aprendizaxe

Learning outcomes	Competences		
Desenvolvemento da capacidade de análise e interpretación gráfica de enunciados, propiedades e situacións de diversa índole prantexados en contextos de enxenaría.	CB1	CE5	CT1 CT3 CT5 CT6
Desenvolvemento da capacidade de abstracción e idealización.	CB1	CE5	CT1 CT4 CT8
Coñecemento dos principios xerais sobre deseño xeométrico.		CE5	CT1 CT3 CT6 CT8
Coñecemento das principais ferramentas e técnicas de representación.	CB1	CE5	CT4 CT6 CT8

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 ó estudante 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	25	50	75
Prácticas con apoio das TIC	24	36	60
Seminario	0	2	2
Resolución de problemas de forma autónoma	0	7.5	7.5
Resolución de problemas e/ou exercicios	2	0	2
Exame de preguntas de desenvolvemento	1	0	1
Exame de preguntas obxectivas	0.5	0	0.5

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

Metodoloxía docente

	Description
Actividades introdutorias	Presentación da materia na data establecida polo Centro. Exercicios de repaso e actualización na 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	Nas sesións prácticas plantexaranse exercicios a resolver 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.
Seminario	Para orientación do traballo, integración nos grupos e resolución de dúbidas.
Resolución de problemas de forma autónoma	Exercicios curtos a resolver polo alumno na casa e un traballo a desenvolver durante o curso para entregar a final, consistente nun mecanismo ensamblado.

Atención personalizada

Methodologies	Description
Seminario	Selección do traballo a desenvolver, con 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	Evaluated Competencess

Lección maxistral	Exame ordinario con preguntas de desenvolvemento e exercicios, a realizar na data establecida polo centro, de teoría e práctica, sobre dos contidos tratados nas distintas sesións.	60	CB1	CE5	CT1 CT3 CT4 CT6 CT8
Prácticas con apoio das TIC	Avaliación das prácticas realizadas semanalmente, con informes periódicos.	30	CB1	CE5	CT1 CT4 CT6
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		CE5	CT1 CT3 CT4 CT5 CT8

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. A asignatura supérase mediante a avaliación continua ó acadar 5,00 puntos en cada unha das 3 partes en que se divide. No caso de non acadar 5,00 en cada parte, a materia tamén pode superarse se en cada parte se supera o 4,5 e a media resulta igual ou superior a 5,00 puntos. No caso de que a media sexa igual ou superior a 5 pero non se chegue ao 4,5 en algunha das partes, a nota que figurará na acta será 4,9.

A mediados do curso realizarase un exame parcial (30% da nota total). A cualificación desta primeira parte será a obtida no exame parcial ou ben na súa recuperación que coincidirá co exame final, no que se realizará tamén o segundo parcial (en data fixada polo centro). 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.

No caso de non seguir o proceso de avaliación continua o alumno poderá presentarse ao exame final da materia, podendo neste caso completarse dito exame co exame das prácticas. A súa cualificación será a obtida en dito exame.

Para a avaliación da segunda oportunidade manteranse as cualificacións das partes superadas anteriormente, debendo recuperarse as non superadas e podendo presentarse tamén ás superadas co obxectivo de mellorar a cualificación final.

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

Bibliografía. Fontes de información

Basic Bibliography

AENOR, **Normas varias, actualizadas**, Segundo cada norma,

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 ter cursado as materias de "Debuxo Técnico" no bacharelato de Ciencias e Tecnolóxico como parte

introductoria, para facilitar o proceso de aprendizaxe.

Plan de Continxencias

Description

Dada a incerteza na evolución da alerta sanitaria provocada polo COVID-19, a Universidade estableceu unha planificación extraordinaria que se activará no intre en que as administracións e a propia institución o determinen, en función de criterios de seguridade, saúde e responsabilidade, para garantir o ensino nun marco non presencial ou parcialmente presencial. A previsión destas medidas garante, no intre requirido, o desenvolvemento da docencia dun xeito máis áxil e eficaz, posto que son coñecidas con anterioridade por estudantes e profesores a través da ferramenta DOCNET
De acordo coas instrucións recibidas da Vicerreitoría de Ordenación Académica e Docencia, debe contemplarse polo menos un único escenario alternativo, previsto para situacións temporais limitadas por restricións locais derivadas de gromos ou peches na localidade en que se localice o centro docente. Neste caso séguense contemplando os tres escenarios do curso anetrior, enumerados a continuación, cos seus correspondentes niveis de continxencia:

ESCENARIO 1. Modalidade Presencial.
Toda a docencia desenvolverase de xeito presencial, tanto para clases teóricas como prácticas, da forma habitual contemplada na presente guía docente, similar aos cursos previos á pandemia, se ben cada vez se completada máis co emprego das ferramentas TIC.

ESCENARIO 2. Modalidade Semipresencial
No caso da activación por parte das autoridades universitarias desta modalidade de ensino mixto, tal circunstancia suporía unha redución da capacidade dos espazos habitualmente empregados para o ensino na modalidade presencial, para o cal como primeira medida o centro comunicará aos profesores da materia a información relativa á nova capacidade autorizada para os espazos de ensino, de xeito que se poida proceder á reorganización das actividades formativas durante o resto do prazo. Cómpre sinalar que a reorganización a realizar dependerá do intre (durante o semestre) no que se active a devandita modalidade de ensino. A reorganización das ensinanzas efectuarase de acordo coa seguinte guía:
a) Comunicación. Informarase a todos os estudantes da materia a través da plataforma MOOVI ou dos medios oportunos das condicións específicas nas que se levarán a cabo as actividades formativas e as restantes probas de avaliación ata rematar o semestre.
b) Adaptación das titorías e atención persoalizada. As sesións de titoría poderán realizarse por medios telemáticos (correo electrónico, videoconferencia, salas virtuais, foros Moovi, etc.), previa concertación de data e hora, nas oficinas virtuais dos profesores.
c) Actividades presenciais e non presenciais. Das restantes actividades para rematar o semestre, indicaranse aquelas actividades formativas que poden realizar todos os estudantes de xeito presencial (priorizando na medida do posible as actividades prácticas) e as actividades de formación que se realizarán de xeito remoto (as clases teóricas son a miúdo as que menos reducen a súa eficiencia con esta modalidade), co propósito de planificar a súa realización efectiva.
d) Contidos e obxectivos de aprendizaxe. Os contidos e os obxectivos de aprendizaxe non serán modificados como consecuencia deste modo de ensino.
e) Programación do ensino. Mantéñense os horarios e o calendario das clases e das diferentes actividades da materia.
f) Bibliografía ou material adicional para facilitar a autoaprendizaxe. O profesorado proporcionará aos estudantes o material didáctico necesario para satisfacer as necesidades de apoio dos estudantes para a materia, segundo as circunstancias existentes en cada momento, a través da plataforma Moovi.
g) Avaliación. De ser preciso o modo non presencial efectuaranse as probas equivalentes aos exames presenciais mediante a plataforma Moodle.

En canto ás ferramentas a empregar nas actividades formativas a desenvolver en modo non presencial, empregaranse as plataformas de Campus Remoto e MOOVI, que se poden complementar con outras solucións para atender necesidades específicas que xurdan ao longo do período.

ESCENARIO 3. Modalidade Non Presencial
No caso de que se active a modalidade de docencia totalmente non presencial (suspensión de todas as actividades de formación e avaliación presenciais), serán prioritarias as plataformas dispoñibles na Universidade de Vigo: Campus Remoto e MOOVI. As condicións da reorganización a realizar dependerán do momento ao longo do semestre no que se active a devandita modalidade docente. Tal reorganización das ensinanzas efectuarase de cordo coa seguinte guía:
a) Comunicación. Informarase aos estudantes a través da plataforma Moovi ou dos medios dispoñibles das condicións específicas nas que se levarán a cabo as actividades de formación e as restantes probas de avaliación para rematar o semestre.
b) Adaptación e/ou modificación de metodoloxías de ensino. A pesar de que as metodoloxías de ensino están fundamentalmente concibidas para a modalidade de docencia presencial, considérase que esencialmente conservan a súa eficiencia nesta modalidade, polo que se propón o seu mantemento prestando especial atención ó seu correcto desenvolvemento.

c) Adaptación das titorías e atención persoalizada. As sesións de titorías realizaranse por medios telemáticos (correo electrónico, videoconferencia, foros de Moovi, salas virtuais de profesores, etc.). No caso das salas virtuais é necesaria a concertación previa da data e hora.
d) Contidos a impartir e obxectivos de aprendizaxe. Salvo indicación contraria, non se modificarán os contidos a impartir nin os obxectivos de aprendizaxe como consecuencia desta modalidade docente.
e) Programación da docencia. Mantéñense os horarios das clases e os calendarios das diferentes actividades.
f) Avaliación. Non se modifica o número de probas nin as respectivas porcentaxes de puntuación nin as datas de realización das mesmas. Tales probas realizaranse empregando Moovi.
g) Bibliografía e material adicional para facilitar a auto-aprendizaxe. O profesorado facilitará aos alumnos o material didáctico necesario para atender as necesidades de apoio aos estudantes na materia, segundo as circunstancias que concorran.

IDENTIFYING DATA				
Mathematics: Calculus II				
Subject	Mathematics: Calculus II			
Code	O07G410V01201			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@dma.uvigo.es			
Web	http://aero.uvigo.es/gl/			
General description	The objective of the subject is that the students know and dominate the basic techniques of the integral calculus, vector calculus, ordinary differential equations and their applications, necessary both for other subjects of the qualifications and the professional exercise. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE1	Capability to solve mathematical problems that may arise in engineering. Aptitude to apply the knowledge about: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and partial derivatives; numerical methods; numerical algorithm; statistics and optimization.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes				
Learning outcomes	Competences			
Knowledge and understanding of the main concepts and techniques of the integral calculus in several variables.	CB1	CG2	CE1 CE32	CT1 CT3 CT4 CT5 CT6 CT8
Knowledge and understanding of the models that adopt the form of ordinary differential equations and the main elementary techniques of integration.	CB1	CG2	CE1 CE32	CT1 CT3 CT4 CT5 CT6 CT8

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

Contents

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

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	28	56	84
Problem solving	15	15	30
Autonomous problem solving	0	13.5	13.5
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 to make contact and gather information on the students, and to present the subject.
Lecturing	The professor will present in the theoretical classes the contents of the subject. Students will have basic reference texts for tracking the subject.
Problem solving	The professor will solve problems and exercises manually and the student will have to solve similar exercises to acquire the necessary skills.
Autonomous problem solving	The students will have to solve exercises independently to check the acquisition of the skills.
Practices through ICT	The professor will solve problems and exercises with computer tools and the student will have to solve similar exercises to acquire the necessary skills.

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess

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

Other comments on the Evaluation

In case of not attending class in person, mixed or non-face-to-face teaching, in order to be eligible for the evaluation it is essential to upload an updated photo to the platform in order to identify the students.
In any call it is necessary to obtain 5 points to pass the subject. The exam will be scored over 10 points. Since the subject has two different parts, it will be necessary to have a minimum of 2 points out of 5 in each part. In the case of obtaining a grade lower than 2 points in any of the parts, the final grade that will appear in the record will be the sum of both notes limiting it to a maximum of 4.8 points. (*)

The maximum duration of any exam will be 3 hours.**Second chance evaluation (assistants):**

Carrying out an exam in which the learning results and the achievement of the competencies indicated in the teaching guide will be evaluated. This exam will provide 100% of the grade of this call.
In the case of having obtained a minimum of 3 points in one part (and not having reached 2 points in the other part), the student can choose to take only the failed part or the complete exam. The criterion indicated in (*) will also apply.
Evaluation procedure for non-assistants (any call):

Carrying out an exam in which the learning results and the achievement of the competencies indicated in the teaching guide will be evaluated. This exam will provide 100% of the grade of this call. The criterion indicated in (*) will also apply.

Dates evaluation:The evaluation schedule officially approved by the EEAE is published on the website http://aero.uvigo.es/es/docencia/examenes/
Ethical commitment:
It is expected that the students present a suitable ethical behaviour. In case to detect an ethical behaviour no suitable (copy, plagiarism, utilisation of electronic devices non authorised, and others) will consider that the student does not gather the necessary requirements to surpass the subject. In this case the global qualification in the present academic course will be of suspense (0.0).

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

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

Sources of information

Basic Bibliography

E. Marsden, A.J. Tromba, **Cálculo Vectorial**, Pearson, 2004
R. Larson, B.H. Edwards, **Cálculo 2 de varias variables**, 10ª, McGraw-Hill, 2016
G.F. Simmons, **Ecuaciones Diferenciales con aplicaciones y notas históricas**, McGraw-Hill, 1993

Complementary Bibliography

A. García et al., **Cálculo II**, CLAGSA, 2002
D.G. Zill, **Ecuaciones diferenciales con aplicaciones de modelado**, 9ª, International Thomson Edit., 2009
A. García et al., **Ecuaciones diferenciales ordinarias**, CLAGSA, 2006
D. Kincaid, W. Cheney, **Análisis numérico: las matemáticas del cálculo científico**, Addison-Wesley Iberoamericana, 1994

Recommendations

Subjects that continue the syllabus

Mathematics: Mathematical methods/O07G410V01301

Subjects that are recommended to be taken simultaneously

Physics: Physics II/O07G410V01202

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.

Contingency plan

Description

In the event of exceptional circumstances:

Elearning platforms/tools
Online tuition will be supported by Campus Remoto and Moovi. Other supplementary platforms may be used to guarantee the accessibility to teaching content.

Tutoring sessions
Tutoring sessions may be carried out online: either asynchronously (e-mail, Moovi, forums, etc.) or by videoconference, in this case by appointment.

Assessment
Exams will be face-to-face unless academic authorities indicate otherwise. In any case, all the comments included in the Assessment section remain valid.

IDENTIFYING DATA				
Physics: Physics II				
Subject	Physics: Physics II			
Code	O07G410V01202			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Salgueiro Piñeiro, Jose Ramon			
Lecturers	Michinel Álvarez, Humberto Javier Salgueiro Piñeiro, Jose Ramon			
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.			

Competencies	
Code	
CB1	That the students demonstrate to possess and understand knowledge in an area of study that is part of the general education (second level), and often found at a level that, although based on advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of the field of study
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE2	Understanding and mastery of the basic concepts about the general laws of mechanics, thermodynamics, fields and waves and electromagnetism and their application to solve problems related to engineering.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes				
Learning outcomes	Competences			
Knowledge and understanding of the basic principles of Physics and their application to the analysis and to the resolution of problems in engineering	CB1	CG2	CE2	CT1 CT3 CT4 CT5 CT6 CT8
Knowledge, understanding and application of the principles of electromagnetism, including telectrostatics, magnetostatics and Maxwell's equations.	CB1		CE2	CT5 CT8
Knowledge, understanding and application of the general laws of classical Thermodynamics, introducing the concept of thermodynamic equilibrium and the most important thermodynamic magnitudes.	CB1		CE2	CT5 CT8

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.

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.

Assessment

	Description	Qualification	Evaluated Competencess		
Essay questions exam	Two control-exams including resolution of problems and questions (that will suppose a total of 20% of the final mark). A final examination that will be 60% of the note. Should the student is not evaluated by means of the control-examination, the final examination will suppose 80% of the mark.	80	CB1	CE2	CT1 CT3 CT8
Report of practices, practicum and external practices	Delivery and oral presentation if necessary of experiments inform and/or activities realized in the laboratory. The students that do not realize experimental work will be specifically evaluated on these aspects at the final exam.	20	CG2	CE2	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

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

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

In the case that the student do not present himself/herself to the control-examinations, the final examination (exam-only assessment) will suppose 80% of the mark and the students that have not atended the laboratory sessions will be evaluated specifically on these aspects the day of the final examination. This applies to the first call exam as well as the second call and end-of-program calls.
The evaluation dates are on the calendar on the website: http://aero.uvigo.es/gl/docencia/exames
=== ADAPTATION OF The EXCEPTIONAL EVALUATION BY The COVID-19===If the evaluation can be made presential, the final mark of the student will be the sum of the following qualifications: Control-examination of the two first chapters (electrostatics and magnetostatics). Up to a point. Control-examination of the rest of the subject. Up to a point Attendance to the laboratory sessions and laboraroty report. Up to two points. Exam of the different contents of the subject. Up to six points.
In case the evaluatrion cannot be made presential, the final mark of the student will be the sum of the following qualifications: Online control-examination of the two first chapters (electrostics and magnetostátics). Up to a point. Online control-examination of the rest of the subject. Up to a point. Attendance to the and works envelope the practices realized in laboratory. Until two points.Attendance to the laboratory sessions and laboraroty report. Up to two points. Online examination on all the contents of the subject. Up to four points

Sources of information

Basic Bibliography

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

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

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

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

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

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

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

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

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

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

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

Jackson J.D., **Classical electrodynamics.**, Elsevier, Amsterdam,
Serrano, V, **Electricidad y Magnetismo: Estrategias para la resolución de problemas y aplicaciones**, Prentice Hall,
Sabah, N.H., **Electric circuits and signals**, CRC Press,
Cheng, D.K., **Field and wave electromagnetics**, Addison Wesley Publishing,
Callen, H. B., **Termodinámica: introducción a las teorías físicas de la termostática del equilibrio y de la termodinámica**, AC, 1981
Münster, A., **Classical thermodynamics**, Wiley Interscience, 1970
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

Contingency plan

Description

=== PLANNED EXCEPTIONAL MEASURES ===

In view of the uncertain and unpredictable evolution of the health alert caused by the COVID-19, the University of Vigo has established an extraordinary planning that will be activated at the time when the administrations and the institution itself determine it in accordance with safety, health and responsibility criteria, and guaranteeing teaching in a non-presential or partially presential scenario. These measures, already planned, guarantee the development of teaching in a more agile and effective way when they are known beforehand (or well in advance) by students and teachers through the standardized and institutionalized tool of teaching guides.

=== ADAPTATION OF METHODOLOGIES ===

* Teaching methodologies that are maintained

Classes are held in person as long as this is permitted by the regulations in force and it can be guaranteed that the students present maintain the necessary separation distance due to the health situation.

* Teaching methodologies that are modified

Online classes will be given simultaneously with face-to-face teaching to those students who, due to space restrictions, cannot access the face-to-face class.

* Non-attendance mechanism for students (mentoring)

All the mentoring will take place in the "remote campus" enabled by the University of Vigo while the situation of "new normality" lasts. An appointment with the professor will be requested by e-mail. In case the rules of personal distance disappear, the mentoting will be held in the office of the professor of the subject.

* Modifications (if necessary) of the contents to be taught

There are no modifications to the contents, except in the case that the health situation prevents the performance of laboratory practices in a face-to-face manner, in which case the students will be entrusted with tasks to be carried out autonomously in a non-presential manner.

* Additional bibliography to facilitate self-learning

In addition to the existing bibliography in electronic format, the use of wikipedia is recommended for the basic contents of the subject when indicated by the teaching staff.

Some contents of the course can be followed remotely for free on the following websites:

https://www.edx.org/course/subject/physics

https://ocw.mit.edu/courses/physics/

https://www.coursera.org/courses?query=physics

The notes made by the teachers of the subject will be made available to the student in Moovi.

* Other modifications

=== ADAPTATION OF THE EVALUATION ===
If the evaluation can be done in person, the student's final grade will be the sum of the following grades:

Control exam of the first two chapters (electrostatics and magnetostatics). Up to 1 point.

Control exam of the rest of the course. Up to 1 point

Assistance and work on the practices carried out in the laboratory. Up to 2 points.

Examination of all the contents of the subject. Up to 6 points

If the evaluation cannot be made in person, the student's final grade will be the sum of the following grades:

Online control test of the first two chapters (electrostatics and magnetostatics). Up to 1 point.

Online control test of the rest of the course. Up to 1 point

Assistance and work on the practices carried out in the laboratory. Up to 2 points.

Delivery of bulletins of problems solved in an autonomous way. Up to 2 points.

Online examination of all the contents of the subject. Up to 4 points

*Additional information

The performance of laboratory practices in person at the facilities of the University of Vigo on the campus of Ourense will be subject to the restrictions of space that may come given the evolution of the health situation and existing regulations. If it is not possible to carry out all the practices, they will be replaced by non-presential activities that the student can carry out remotely.

Translated with www.DeepL.com/Translator (free version)

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

Competencias	
Code	
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
CE4	Capacidade para comprender e aplicar os principios de coñecementos básicos da química xeral, química orgánica e inorgánica e as súas aplicacións na enxeñaría.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT8	Capacidade de razoamento crítico e autocrítico
CT9	Capacidade de traballo en equipo de carácter interdisciplinar
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecemento, comprensión e aplicación dos principios químicos relacionados coa súa aplicación na enxeñaría	CB1	CE4	CT1 CT3 CT4 CT5 CT8 CT9 CT13
Coñecemento das propiedades químicas máis destacadas en relación co comportamento dos materiais	CB1	CE4	CT1 CT3 CT4 CT5 CT8 CT9 CT13

Contidos	
Topic	
TEMA 1. ASPECTOS XERAIS E CONCEPTOS PREVIOS	1.1 Magnitudes, dimensións, unidades e sistemas de unidades 1.2 Cambios de unidades 1.3 Ecuacións dimensionais e adimensionais 1.4 Modos de expresión da concentración 1.5 Estequiometría e conceptos relacionados

TEMA 2. O ÁTOMO	2.1 Estrutura e partículas constituíntes 2.2 Teoría atómica: orbitais atómicos 2.3 Orbitais atómicos e enerxía: estruturas atómicas 2.4 Características dos átomos 2.5 Isótopos
TEMA 3. ENLACE COVALENTE	3.1 Natureza do enlace químico 3.2 Teoría de Lewis: estruturas moleculares 3.3 Xeometría molecular 3.4 Teoría de enlace-valencia 3.4 Teoría de orbitais moleculares
TEMA 4. ENLACE IÓNICO	4.1 Lóns 4.2 Sólidos iónicos: natureza 4.3 Enerxía de rede 4.4 Propiedades dos sólidos iónicos
TEMA 5. ENLACE METÁLICO	5.1 Sólidos metálicos 5.2 Enlace metálico
TEMA 6. INTERACCIÓNS INTERMOLECULARES	6.1 Natureza das interaccións intermoleculares 6.2 Tipos de interaccións intermoleculares 6.3 Interaccións moleculares e estados de agregación da materia
TEMA 7. GASES E DISOLUCIÓNS	7.1 Estado gas: características 7.2 Gases ideais 7.3 Gases reais 7.4 Disolucións 7.5 Líquidos e disolucións líquidas 7.6 Propiedades coligativas das disolucións
TEMA 8. TERMOQUÍMICA	8.1 Calor, enerxía interna e entalpía 8.2 Cambios entálpicos asociados a reaccións químicas 8.3 Entropía e enerxía libre: criterio de evolución espontánea das reaccións quìmicas
TEMA 9. EQUILIBRIO QUÍMICO	9.1 Concepto de equilibrio 9.2 Constante de equilibrio 9.3 Tipos de equilibrios 9.4 Cociente de reacción 9.5 Principio de Le Chatelier 9.6 Relacións termodinámicas
TEMA 10. EQUILIBRIO ÁCIDO-BASE	10.1 Definicións de ácido e base. 10.2 Autoionización do auga e produto iónico. pH e pOH 10.3 Forteza de ácidos e bases. Cálculo do pH 10.4 Ácidos polipróticos 10.5 Hidrólisis 10.6 Disolucións reguladoras
TEMA 11. EQUILIBRIO DE SOLUBILIDADE	11.1 Compostos solubles e pouco solubles 11.2 Compostos pouco solubles: solubilidade e produto de solubilidade 11.3 Factores que afectan á solubilidade 11.4 Precipitación fraccionada
TEMA 12. EQUILIBRIO REDOX	12.1 Conceptos básicos de oxidación e redución 12.2 Reaccións redox: axuste en medio ácido ou básico 12.3 Valoracións redox
TEMA 13. ELECTROQUÍMICA	13.1 Celas electroquímicas: conceptos básicos 13.2 Potenciais estándar de electrodo e de cela 13.3 Termodinámica das reaccións electroquímicas 13.4 Ecuación de Nerst. Aplicacións 13.5 Baterías e pilas 13.6 Procesos industriais de electrólisis 13.7 Corrosión
TEMA 14. CINÉTICA QUÍMICA	14.1 Conceptos básicos: velocidade de reacción 14.2 Factores que modifican a velocidade dunha reacción química 14.3 Determinación da ecuación cinética dunha reacción química

TEMA 15. INTRODUCCIÓN Á QUÍMICA ORGÁNICA	15.1 Estrutura dos compostos orgánicos 15.2 Alcanos, alquenos, alquinos e derivaddos haloxenados dos hidrocarburos 15.3 Hidrocarburos aromáticos 15.4 Alcohois, fenoles e éteres 15.5 Aldehídos e cetonas 15.6 Ácidos carboxílicos, ésteres e derivados 15.7 Aminas e amidas 15.8 Nitrilos e nitroderivados 15.9 Reaccións dos compostos orgánicos 15.10 A química orgánica na industria aeroespacial
TEMA 16. PETRÓLEO E GAS NATURAL	16.1. Petróleo: definición, composición e refino. 16.2. Gas natural: definición, composición e aplicacións.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	24	48	72
Seminario	14	49.5	63.5
Prácticas de laboratorio	12	0	12
Resolución de problemas e/ou exercicios	2	0	2
Exame de preguntas obxectivas	0.5	0	0.5

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

Metodoloxía docente

	Description
Lección maxistral	Expoñeranse os fundamentos teóricos e prácticos de cada un dos temas da materia, co apoio da bibliografía e materiais audiovisuaps. Estimularase a participación do alumnado.
Seminario	De xeito paralelo ás sesións maxistrais, nos seminarios abordaranse exercicios relacionados coa materia. O alumno dispoñerá previamente de boletíns que inclúan todos os exercicios da materia. Contémplase a posibilidade de que os alumnos resolvan de modo autónomo unha parte dos mesmos
Prácticas de laboratorio	Os alumnos realizarán prácticas relacionadas cos contidos da asignatura co obxectivo de que adquiran destrezas relacionadas co manexo de materiais, reactivos e instrumentos habituais nun laboratorio.

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess		
Lección maxistral	Avaliarase, mediante a realización en aula de varios test, a consecución dos resultados de aprendizaxe e as competencias relacionadas cos contidos teóricos da materia vistos en clases de teoría.	10	CB1	CE4	CT1 CT4 CT5 CT8
Seminario	Avaliarase, mediante a resolución en aula de varios problemas, a consecución dos resultados de aprendizaxe e as competencias relacionadas coa aplicación dos conceptos da materia.	10	CB1	CE4	CT1 CT3 CT4 CT5 CT8 CT9

Prácticas de laboratorio	A realización das prácticas é requisito "sine qua non" para aprobar a materia. Ao finalizar as prácticas realizarase unha proba tipo test ou de preguntas de resposta curta sobre os contidos das mesmas que terá un valor de 5%. Tamén se otorga un valor de 5% á actitude e o traballo durante a estancia no laboratorio.	10	CB1	CE4	CT1 CT4 CT5 CT8 CT9 CT13
Resolución de problemas e/ou exercicios	Nas datas oficiais farase un exame de resolución de problemas e/ou exercicios da materia, para avaliar a consecución dos resultados de aprendizaxe relacionados coa aplicación a problemas dos conceptos da materia.	40	CB1	CE4	CT1 CT3 CT4 CT5 CT8 CT9
Exame de preguntas obxectivas	Nas datas oficiais farase un examen tipo test para avaliar os resultados de aprendizaxe relacionados cos contidos teóricos da materia.	30	CB1	CE4	CT1 CT4 CT5 CT8

Other comments on the Evaluation

A) Convocatorias 1ª e 2ª Oportunidade

Con carácter xeral, a avaliación da materia será continua e a calificación final se determinará de acordo coa siguiente ponderación:

exames de teoría, 30%; exames de problemas, 40%; prácticas de laboratorio, 10%; test en aula, 10%; problemas en aula, 10%

Prácticas de laboratorio

De forma xeral, a realización das prácticas de laboratorio dunha maneira satisfactoria é requisito indispensable para superar a materia. Por outra parte, se realizará un exame tipo cuestionario, para o cal se fixará unha convocatoria específica. A calificación das prácticas dependerá da labor experimental realizada no laboratorio e da nota obtida no cuestionario. Esta nota quedará consolidada para a 2ª oportunidade. Os alumnos que fixeron as prácticas en cursos anteriores conservarán a nota conseguida no seu momento.

Entregas de aula

Ao longo do curso, se organizará a realización de 4 entregas: 2 relativas á parte A (Temas 1-8) e 2 relativas á parte B (Temas 9-15). Cada entrega terá unha duración de 1 hora e consistirá en 1 cuestionario de 10 preguntas tipo test e 2 problemas. Todas estas entregas se farán na aula habitual e en horario de clase. A nota das entregas quedará consolidada para a segunda oportunidade.

Examen parcial

Ao finalizar a parte A da materia (Temas 1-8) se realizará un exame parcial, que é opcional. Se considerará que o parcial está aprobado cando se obteña como mínimo un 3.5/10 en teoría e un 3.5/10 en problemas e 5 no resultado de aplicar a ecuación:

Nota parcial A=nota teoría*0.40+ nota problemas*0.60.

Aqueles alumnos que superen o parciall terán que examinarse somentes da Parte B nas datas fixadas oficialmente para os exames de 1ª e 2ª oportunidade.

Cálculo da nota final e restricciónes

A nota final da materia será o resultado de aplicar a seguinte ecuación:

Nota final=Nota teoría*0.30+Nota problemas*0.40+Tests en aula*0.10+Problemas en aula*0.10+Prácticas*0.10

Para superar a materia ha de obterse unha nota igual ou superior a 5. Sin embargo, nos casos nos que o resultado de aplicar a ecuación anterior iguale ou supere o valor de 5, pero non se cumpla o requisito das notas mínimas antes citado (3.5/10 puntos en teoría e 3.5/10 puntos en problemas), a nota en actas será 4.9 (suspenso).

B) Convocatoria Fin de Carreira e modalidade non presencial

Aqueles alumnos con responsabilidades laborais ou situación persoal excepcional poderán solicitar ao coordinador da

materia (sempre antes do 31 de marzo) ser avaliados mediante una avaliación única (modalidade non presencial). Para elo, deberán acreditar a devandita situación. Nestes casos, a nota final da materia se calculará da seguinte forma:

Nota final=Nota teoría*0.40+Nota problemas*0.60

Para superar a materia ha de obterse unha nota igual ou superior a 5. Sin embargo, nos casos nos que o resultado de aplicar a ecuación anterior iguale ou supere o valor de 5, pero non se cumpla o requisito das notas mínimas antes citado (3.5/10 puntos en teoría e 3.5/10 puntos en problemas), a nota en actas será 4.9 (suspenso).

Para a convocatoria de Fin de Carrera, a avaliación se realizará mediante un exame teoría e un exame de problemas e a nota se calculará de maneira idéntica á descrita para alumnos en modalidad non presencial.

As datas dos exames serán as publicadas no taboleiro de anuncios e/ou na web do Centro. O exames realizaranse de forma presencial, salvo que a U. de Vigo decida o contrario.

Bibliografía. Fontes de información

Basic Bibliography

Petrucci, R. H., Herring, F.G., Madura, J.D., Bissonnette, C, **Fundamentos de Química**, 10,
M. A. Domínguez, **Problemas resueltos de química. La ciencia básica**, Paraninfo, 2007
J. A. López Cancio, **Problemas de Química**, Prentice Hall, 2000
Chang, R., **Química**, 11,

Complementary Bibliography

Atkins, P.; Jones, L., **Química**, 2,
E. Quiñoá Cabana, **Nomenclatura y formulación de los compuestos inorgánicos**, 2,
Herrero Villén, M.A., Atienza Boronat, J.A., Nogera Murray, P.; Tortajada Genaro, L.A., **La Química en problemas. Un enfoque práctico**, 1,
Llorens Molina, J.A., **Ejercicios para la introducción a la Química Orgánica**, 1,
Sánchez Coronilla, A., **Resolución de Problemas de Química**, 1,

Recomendacións

Subjects that are recommended to be taken simultaneously

Física: Física II/O07G410V01202
Matemáticas: Cálculo II/O07G410V01201

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103
Matemáticas: Cálculo I/O07G410V01101

Other comments

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

Recoméndase, en todo caso, revisar aspectos como cambios de unidades, formulación en química inorgánica, concepto de peso molecular e mol, axuste de reaccións químicas e cálculos estequiométricos con e sin reactivo limitante.

Plan de Continxencias

Description

1. MODALIDADE MIXTA
1.1. ADAPTACIÓN DAS METODOLOXÍAS
1.1.1. SESIÓN MAXISTRAL.
As clases impartiranse se é posible en modo presencial e en quenda de mañán empregando aulas con capacidade suficiente para todos os alumnos. Se isto non fora viable, impartiríanse en horario habitual (mañán) e empregando os recursos do campus remoto de maneira que parte dos alumnos estarían na aula e parte nos seus domicilios. Para este fin, empregaríanse as presentacións en PowerPoint e unha tableta dixitalizadora como elemento de apoio para calquera aclaración.
1.1.2. SEMINARIOS
Os seminarios impartiranse se é posible en modo presencial e en quenda de mañán empregando aulas con capacidade suficiente para todos os alumnos. Se isto non fora viable, se impartirían en horario habitual e empregando os recursos do campus remoto de maneira que parte dos grupos estarían no aula e parte nos seus domicilios. As entregas de aula (problemas e cuestionarios) faríanse sempre en aula mantendo as medidas anticovid.

1.1.3. PRÁCTICAS DE LABORATORIO
Ante a imposibilidade de levar a cabo as prácticas de laboratorio de forma individual (só poderían estar 6 alumnos á vez), éstas se farán a modo de demostración nun aula grande e con participación (por turnos) dos alumnos nas tarefas.
O traballo completaráse co tratamento de datos e a realización dunha proba consistente nun cuestionario de preguntas de resposta curta ou tipo test.

1.2. AVALIACIÓN
1.2.1. FIN DE CARREIRA: A avaliación en modalidade mixta será igual á da modalidade presencial e os exames se farán en aula.
1.2.2. FIN DE CUATRIMESTRE: A avaliación de fin de cuatrimestre en modalidade mixta será igual á da modalidade presencial e os exames se farán en aula.
1.2.3. SEGUNDA OPORTUNIDADE. A avaliación de segunda oportunidade en modalidade mixta será igual á da modalidade presencial e os exames se fará en aula.

1.3. TITORÍAS
As titorías relativas á docencia das clases tipo A (teoría) e B (seminario) realizaránse nos despachos virtuais do Profesor José Luis Alonso (despacho 53) e da Profesora Sandra Rivas (despacho virtual 2160) a través do campus remoto en horario de titorías e pedindo cita previa a través do correo electrónico. As titorías relativa ás prácticas (horas tipo C) seguirán o mesmo procedemento empregando o despacho virtual do Prof. Juan Carlos Parajó (despacho 1841).

1.4. OUTROS.
Facilitarase documentación e material adicional (problemas resoltos detalladamente, vídeos explicativos, píldoras, cuestionarios de autoavaliación, etc.) que axuden a conseguir os resultados de aprendizaxe asociados ás competencias obxectivo.

2. MODALIDADE NON PRESENCIAL
2.1. ADAPTACIÓN DAS METODOLOXÍAS
2.1.1. SESIÓN MAXISTRAL
As clases impartiranse en modo online e en horario habitual (mañáns). Para este fin, se empregarán as presentacións en PowerPoint e unha tableta dixitalizadora como elemento de apoio para calquera aclaración.
2.1.2. SEMINARIOS
Os seminarios impartiranse en horario habitual e empregando unha tableta dixitalizadora e demáis recursos do campus remoto. As entregas (problemas e cuestionarios) cuxa calificación forma parte da avaliación continua se farán a través do campus remoto.
2.1.3. PRÁCTICAS DE LABORATORIO
As prácticas se impartirán en modo non presencial usando o campus remoto e materiais audiovisuais elaborados polos profesores. O traballo completarase co tratamento de datos e a realización dunha proba consistente nun cuestionario de preguntas de resposta curta ou tipo test, que se faría de forma remota.

2.2. AVALIACIÓN
2.2.1. FIN DE CARREIRA: A avaliación en modalidade non presencial será igual á da modalidade presencial.
2.2.2. FIN DE CUATRIMESTRE: A avaliación de fin de cuatrimestre en modalidade non presencial se fará de acordo cos seguintes criterios: exame teoría tipo test, 35%; exame problemas, 45%; problemas resoltos en domicilio e de forma autónoma, 5%; cuestionarios en domicilio, 5%; prácticas, 10%. Aqueles alumnos que demostren ter responsabilidades laboráis ou unha situacion especial poderán ser avaliados soamente cun exame de toda a materia cun valor do 100% (teoría, 40%; problemas, 60%).
2.2.3. SEGUNDA OPORTUNIDADE. A avaliación de segunda oportunidade en modalidade non presencial será igual á da modalidade presencial. Aqueles alumnos que demostren ter responsabilidades laboráis ou outra situación especial poderán ser avaliados soamente cun exame de toda a materia cun valor do 100% (teoría, 40%; problemas, 60%).

2.3. TITORÍAS
As titorías relativas á docencia das clases tipo A (teoría) e B (seminario) realizaránse nos despachos virtuais do Profesor José Luis Alonso (despacho 53) e da Profesora Sandra Rivas (despacho 2160) a través do campus remoto en horario de titorías e pedindo cita previa a través do correo electrónico. As titorías relativa ás prácticas (horas tipo C) seguirán o mesmo procedemento empregando o despacho virtual do Prof. Juan Carlos Parajó (despacho 1841).

2.4. OUTROS
Facilitarase documentación e material adicional (problemas resoltos detalladamente, vídeos explicativos, píldoras, cuestionarios de autoavaliación, etc.) que axuden a conseguir os resultados de aprendizaxe.

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

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

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

- Coñecemento dos aspectos básicos dos tipos de empresas e a súa xestión e organización	CB1	CG2 CG8	CE6	CT1 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT12

Contidos

Topic
A Empresa no Sistema Económico
Dirección Comercial
Dirección Financeira
Natureza e Estrutura Organizativa das Empresas: cambio e innovación
Organizacións e Recursos Humanos: motivación e liderado

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	30	60
Actividades introdutorias	1	1	2
Estudo de casos	18	35	53
Resolución de problemas e/ou exercicios	1.5	16.5	18
Resolución de problemas e/ou exercicios	3	14	17

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

Metodoloxía docente

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

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess			
Resolución de problemas e/ou exercicios	Exames parciais e/ou final sobre contido teórico-práctico da materia	60	CB1	CG2 CG5 CG8	CE6	CT1 CT3 CT4 CT5
Resolución de problemas e/ou exercicios	Entrega de exercicios, informes, resolución de problemas e toma de decisións, individual e en grupo (de forma autónoma)	40	CB1	CG2 CG5 CG8	CE6	CT1 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT12

Other comments on the Evaluation

A planificación da materia supón a aplicación dun sistema de avaliación continua (asistencia mínima do 80%). Polo que a cualificación final obterase da avaliación dos traballos de aula e realización dun exame final. Para ter en conta ditas cualificacións é necesario obter unha nota mínima de 4 sobre 10 no exame final. As datas e horarios das probas de avaliación das diferentes convocatorias son as especificadas no calendario de probas de avaliación aprobado pola xunta de centro para o curso 2020-2021. En caso de conflito ou disparidade entre as datas dos exames, prevalecerán as sinaladas na páxina web da titulación. Segunda convocatoria: a nota correspondente aos traballos de aula (40% da nota final) conservarase durante un curso académico, convocatorias de xuño e xullo. O estudantado non asistente pode participar nun exame final que cobre todo o contido da materia.

Bibliografía. Fontes de información

Basic Bibliography

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

Schilling, M.A., **Dirección Estratégica de la Innovación Tecnológica**, 2008,

Complementary Bibliography

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

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

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

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

Recomendacións

Subjects that continue the syllabus

Dirección e xestión de proxectos/O07G410V01701

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen, datas de probas parciais e exposición de traballos

* Metodoloxías docentes que se modifican; porcentaxes de avaliación e teledocencia

* Mecanismo non presencial de atención ao alumnado (titorías); a través de campus remoto

* Modificacións (se proceder) dos contidos a impartir

* Bibliografía adicional para facilitar a auto-aprendizaxe

* Outras modificacións

=== ADAPTACIÓN DA AVALIACIÓN ===
* En caso de teledocencia o 50% dependerá dos exames parciais e o 50% según o aproveitamento das prácticas, seminarios e o informe e exposición do traballo sobre unha empresa do sector.
* Novas probas

* Información adicional

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

Competencias	
Code	
CB1	Que os estudantes demostrasen posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral, e adóitase atopar a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG3	Instalación, explotación e mantemento no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG4	Verificación e Certificación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG6	Capacidade para participar nos programas de probas en voo para a toma de datos das distancias de despegamento, velocidades de ascenso, velocidades de perdas, maniobrabilidad e capacidades de aterraxe.
CG7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.
CG8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.
CE9	Comprender a globalidade do sistema de navegación aérea e a complexidade do tráfico aéreo.
CE10	Comprender como as forzas aerodinámicas determinan a dinámica do voo e o papel das distintas variables involucradas no fenómeno do voo.
CE13	Comprender a singularidade das infraestruturas, edificacións e funcionamento dos aeroportos.
CE17	Coñecemento adecuado e aplicado á enxeñaría de: Os elementos fundamentais dos diversos tipos de aeronaves; os elementos funcionais do sistema de navegación aérea e as instalacións eléctricas e electrónicas asociadas; os fundamentos do deseño e construción de aeroportos e os seus diversos elementos.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT1	Capacidade de análise, organización e planificación
CT2	Liderado, iniciativa e espírito emprendedor
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT9	Capacidade de traballo en equipo de carácter interdisciplinar
CT12	Compromiso ético e democrático

CT13 Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe				
Learning outcomes	Competences			
Coñecemento xeral da tecnoloxía aeroespacial	CB1	CG1 CG2 CG3 CG4 CG6 CG8	CE9 CE10 CE13 CE17 CE18 CE19	CT1 CT2 CT3 CT4 CT6 CT8 CT9 CT12 CT13
Coñecemento, comprensión e aplicación dos fundamentos do voo atmosférico das aeronaves, incluíndo os lanzadores e misiles	CB1	CG1 CG2 CG3 CG4 CG6	CE9 CE10 CE17 CE18 CE19	CT1 CT3 CT4 CT6 CT8 CT9 CT13
Coñecemento, comprensión e aplicación dos fundamentos do voo orbital dos vehículos espaciais	CB1	CG1 CG2 CG3 CG4 CG7 CG8	CE10 CE18	CT1 CT3 CT4 CT6 CT8 CT13
Coñecemento, comprensión e aplicación das distintas infraestruturas aeroportuarias e a navegación aérea	CB1	CG1 CG2 CG3 CG4 CG6 CG7 CG8	CE9 CE13 CE17 CE19	CT1 CT3 CT4 CT6 CT8 CT9 CT13

Contidos	
Topic	
Industria Aeroespacial	- Introdución a industria aeroespacial - Organizacións aeronáuticas e espaciais
Infraestruturas Aeroportuarias	- Sistema Aeroportuario - Lonxitude de pista de voo - Configuración dos aeroportos - Terminais Aeroportuarias
Navegación e circulación aérea	- Seguridade na navegación aérea - Navegación e circulación aérea - Marco legal - Convenio de Aviación Civil Internacional - Marco organizativo - Sistema CNS - ATM - Marco técnico - Sistemas non autónomos. Axudas á navegación - Rutas e cartas aéreas - Organización do espazo aéreo
Vehículos aeroespaciais	- Clasificación de vehículos aeroespaciais - Aerostatos e aerodinos - Vehículos espaciais - Aeronaves de á rotativa
Arquitectura do avión	- Partes do avión - Materiais - Procesos de fabricación
Aerodinámica de perfís	- Orixe das cargas aerodinámicas - Perfís aerodinámicos - Curvas características - Entrada en perda de perfís - Perfís en réxime compresible

Actuacións do avión	- Forzas externas sobre o avión - Voo horizontal, rectilíneo e uniforme - Ascenso, descenso e planeo - Viraxe no plano vertical - Viraxe no plano horizontal - Actuacións en pista - Alcance - Autonomía
Sistemas de propulsión	- Introdución á propulsión - Propulsión a hélice - Propulsión a chorro
Instrumentos das aeronaves	- Instrumentos de voo e navegación - Instrumentos da planta propulsora - Agrupamento dos instrumentos

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	26	52	78
Design Thinking	6	24	30
Resolución de problemas	12	16	28
Presentación	5	5.5	10.5
Exame de preguntas obxectivas	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.
Design Thinking	O profesor presentará un tema sobre o que se levará a cabo un proxecto de industrialización do sector aeroespacial. O traballo desenvolverase en equipos / grupos de estudantes. O obxectivo desta actividade é a resolución de problemas complexos baseados na lóxica, a imaxinación, a intuición e o razoamento sistémico de cada estudante
Resolución de problemas	O profesor resolverá problemas e exercicios tipo de forma manual e o estudantado terá que resolver exercicios similares para adquirir as capacidades necesarias.
Presentación	O profesor proporá un proxecto real e actual do sector aeroespacial e o estudantado fará un exercicio de análisis, redactará unha proposta técnica fará a presentación de dita proposta nun tempo reglado na aula. Mediante debate o estudantado será partícipe da avaliación de cada proposta. A presentación de dito proxecto será a finales do curso co fin de aplicar todos os coñecementos adquiridos na materia.

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas	Realizaranse probas escritas curtas para avaliar a adquisición de coñecemento de forma autónoma.	20	CG1 CG2 CG3 CG4 CG7 CG8	CE13 CE17 CE19	CT1 CT2 CT3 CT4 CT6 CT8 CT9 CT12 CT13

Exame de preguntas obxectivas	Exame parcial que constará de preguntas tipo test e de resposta curta.	30	CB1	CG3 CG4 CG6	CE9 CE10 CE13 CE17 CE18 CE19	CT4 CT8
Exame de preguntas de desenvolvemento	Realizarase un exame final sobre os contidos da totalidade da materia.	50	CB1	CG1 CG2 CG3 CG4 CG6 CG7 CG8	CE9 CE10 CE13 CE17 CE18 CE19	CT1 CT3 CT4 CT8 CT13

Other comments on the Evaluation

"*As probas de avaliación continua (exames parciais) realizaranse dentro do horario lectivo*"

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

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución dá alerta sanitaria provocada pola COVID- 19, a Universidade establece unha planificación extraordinaria que se activará non momento en que as administracións e a propia institución ou determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, non momento que sexa preceptivo, ou desenvolvemento dá docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e ou profesorado a través dá ferramenta normalizada e institucionalizada dás guías docentes DOCNET.

Metodoloxías docentes que se modifican

Lección maxistral: alternativamente, realizarase a través dá plataforma de Campus Remoto da Universidade de Vigo.

Clases Prácticas: En lugar de efectuar prácticas grupales, mantéñense as mesmas actividades pero de maneira individualizada cun contido simplificado pero mantendo os puntos da programación.

Seminarios: alternativamente, as tutorías realizaranse de forma remota segundo o apartado de Atención Personalizada en calquera horario acordado co alumnado.

Mecanismo non presencial de atención ao alumnado (tutorías)

As sesións de tutoría realizaranse alternativamente por medios telemáticos (email ó videoconferencia) baixo a modalidade de concertación previa.

Outras modificacións

=== ADAPTACIÓN DA AVALIACIÓN ===

- Parcial 1: 20% nota final
- Parcial 2: 20% nota final

Actividades que o alumnado pode completar no seu domicilio:
- Actividades de teoría: Resolución de cuestións nas que o alumnado utilizará os medios virtuais como internet, bibliografía da materia, apuntamentos para a consulta de exemplos, documentación e comprensión de cuestones soble a materia co fin de afianzar coñecementos. 5% dá nota final
- Resolución de problemas 5% dá nota final

- Exame final (50% dá nota final)

Tanto os examenes parciais e finais, constarán dun cuestionario tipo test de única resposta sobre os contidos de toda a materia + Resolución de problemas nos que se esixirá a entrega do problema resolto. Calquera medio dispoñible será tido en conta para a entrega das resolucións Fotos, escáner, documento a computador, etc. Utilizaranse as ferramentas que a Universidade de Vigo pon a disposición para devandito fin.

A convocatoria de segunda oportunidade constará dun exame final polo 100% da avaliación de forma remota. Será un exame combinado do tipo escrito e oral utilizando as ferramentas que a Universidade de Vigo pon a disposición para devandito fin.

IDENTIFYING DATA

Mathematics: Mathematical methods

Subject	Mathematics: Mathematical methods			
Code	O07G410V01301			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@dma.uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this subject is that the students know and master the basic techniques of the complex variable and its applications, the partial differential equations and their applications; necessary both for other subjects of the degree and for professional practice. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies

Code	
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes

Learning outcomes	Competences		
LO1: Knowledge and understanding of the basic technicians of Complex Variable that are of application in the field of the Aerospace Engineering.	CG2	CE32	CT1 CT3 CT4 CT5 CT6 CT8
LO2: Understanding the basic models that, in the form of partial differential equations are applicable in Aerospace Engineering. Knowledge and application of the methods of basic resolution for this type of models.	CG2	CE32	CT1 CT3 CT4 CT5 CT6 CT8

Contents

Topic

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

Planning

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

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Problem solving	Realization in an autonomous way of a collection of problems of each block of content. LO1, LO2	40	CG2	CE32	CT1 CT3 CT4 CT5 CT6 CT8

Essay questions exam	Realization of a final exam in which they collect the corresponding contents to the master sessions and to the resolution of problems. LO1, LO2	60	CG2	CE32	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

In case of not attending class in person, mixed or non-face-to-face teaching, in order to be eligible for the evaluation it is essential to upload an updated photo to the platform in order to identify the students.

In any call it is necessary to obtain 5 points to pass the subject. The maximum duration of any exam will be 3 hours. Since the subject has two distinct parts, it will be necessary to have a minimum of 2 points out of 5 in each part. In the case of obtaining a grade lower than 2 points in any of the parts, the final grade that will appear in the certificate will be the sum of both notes limiting it to a maximum of 4.8 points. (*)

Second chance evaluation (attendees):

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

In the case of having obtained a minimum of 3 points in one part (and not having reached 2 points in the other part), the student can choose to perform only the suspended part or the complete exam. The criterion indicated in (*) will also apply.

Procedure of evaluation for non-attendees (any call):

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

Evaluation dates:

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

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

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

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

Sources of information

Basic Bibliography

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

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

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

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

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

Complementary Bibliography

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

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

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

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

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

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

Contingency plan

Description

In the event of exceptional circumstances:

Elearning platforms/tools
Online tuition will be supported by Campus Remoto and FAITIC. Other supplementary platforms may be used to guarantee the accessibility to teaching content.

Tutoring sessions
Tutoring sessions may be carried out online: either asynchronously (e-mail, FAITIC, forums, etc.) or by videoconference, in this case by appointment.

Assessment
Exams will be face-to-face unless academic authorities indicate otherwise. In any case, all the comments included in the Assessment section remain valid.

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

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

Learning outcomes		
Learning outcomes	Competences	
Capacity to analyse electrical circuits and its application in the resolution of real problems		CT1 CT3 CT4 CT5 CT6 CT8 CT13
Basic knowledge of electrical machines and their utilization	CE17	CT1 CT3 CT4 CT5 CT6 CT8 CT13

Capacity to design and calculate basic electrical installations	CG1 CG4	CE17	CT1 CT3 CT4 CT5 CT6 CT8 CT13

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Problem solving	18.5	20	38.5
Autonomous problem solving	1.5	27.5	29
Laboratory practical	10	10	20
Essay questions exam	2.5	0	2.5

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

Methodologies	
	Description
Lecturing	The professor will expose in the classes of large groups the contents of the matter.
Problem solving	Problems and type exercises will be exposed and solved in the classes of large groups as a guide for the students.
Autonomous problem solving	It is highly advisable that the student try to solve exercises and issues of the subject proposed by the professor.
Laboratory practical	Practical assemblies corresponding to the contents seen in the classroom will be made in the laboratory, or complementary aspects not treated in the theoretical classes will be treated.

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

Assessment

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

Other comments on the Evaluation

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

It is considered by default that students will course the matter through the **on-site modality**. In case of students who want to take advantage of the out-site modality, due to facts such as job responsibilities or others in similar circumstances, they should contact the person in charge of the matter. These students will have to adduce reasonable and proven causes for such a decision and they will be addressed, in each case, how they will take the course and do the examinations on the "laboratory practices" and "resolution of autonomous problems" methodology. The rest of the evaluation will be the same as the on-site students.

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

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

If a grade of 3 or lower is achieved in some parts of the general exam, and even if the global grade achieved is equal or higher than 5.0, the maximum grade obtained will be 4.5.

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

The continuous evaluation activities will be carried out within school hours.

The professor of this matter will allow the students to take a final exam in order to reach better qualifications, so those students who **have not taken the continuous evaluation or** are willing to **improve their qualifications** should take

an additional exam following the general exam, both on the **first and second callls**, which will include questions related to the contents of the teaching in "laboratory practices" and "resolution of autonomous problems", evaluable for 0 to 10, and that may be the 30% of the final qualification. In such case, the qualification to be taken into account to assess the continuous evaluation activities will be the achieved in the last qualification.

Regarding the **qualifications obtained in the partial examination or on the first call**, the qualification of the section passed will be kept, until the **second call**, if a score of 5 points out of 10 is achieved. Then, the student may:

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

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

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

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

- the maximum duration of the general examination will be 2,5 hours (corresponding to 1.25 hours each section)

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

Students are expected to exhibit adequate ethical behavior. Plagiarism is regarded as serious dishonest behavior. If any form of plagiarism is detected in any of continuous evaluation activities 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

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

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

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

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

Complementary Bibliography

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

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

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

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematical methods/O07G410V01301

Subjects that it is recommended to have taken before

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained
In the case of distance and blended learning, the same teaching methodologies are maintained as in classroom teaching using the telematic means that the University makes available to teachers and students (moovi, Remote Campus and / or Integra Campus, etc.)

* Teaching methodologies modified
Depending on the health alert situation caused by COVID-19, the classroom laboratory practice groups they will adjust to the limits of capacity established by the University of Vigo for the laboratory.
If the practices cannot be carried out in the laboratory, they will replaced by simulation practices using Matlab/Simulink/Simscape/Simscape Electrical programs.
Due to possible capacity problems, exceptionally for this academic year, the grade obtained in the practices may be kept for students of the 2020-2021 academic year, previous confirmation of the students before the start of the practices.

* Non-attendance mechanisms for student attention (tutoring)
The tutorials, in the case of virtual or mixed teaching, will be carried out telematically through the use of the telematics tools available for teachers and students (moovi, email, Remote Campus, Integra Campus, phone etc.)

* Modifications (if applicable) of the contents
No change

* Additional bibliography to facilitate self-learning
It is not considered necessary, in addition to the bibliography already specified, solved problems and self-evaluation are provided to via moovi.

* Other modifications
No change

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
The face-to-face tests carried out maintain their value and weight in the global evaluation.

* Pending tests that are maintained
The tests pending to be carried out are maintained with their value and weight in the global evaluation, carried out through the different tools made available to teachers and students (moovi, Remote Campus, Integra Campus, etc.)

* Tests that are modified
No change

* New tests
No change

* Additional Information
The appropriate evaluation criteria are maintained to carry out the tests, if necessary and for indication in Rectoral Resolution, using the telematic means made available to the teaching staff.

IDENTIFYING DATA

Termodinámica

Subject	Termodinámica			
Code	O07G410V01303			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	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 Termodinámica.			

Competencias

Code	
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE8	Comprender os ciclos termodinámicos xeradores de potencia mecánica e pulo.
CE16	Coñecemento adecuado e aplicado á Enxeñaría de: Os conceptos e as leis que gobernan os procesos de transferencia de enerxía, o movemento dos fluídos, os mecanismos de transmisión de calor e o cambio de materia e o seu papel na análise dos principais sistemas de propulsión aeroespaciais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

Resultados de aprendizaxe

Learning outcomes	Competences		
RA1: Coñecemento, comprensión, análise e síntese dos principios e métodos da Termodinámica.	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8
RA2: Coñecemento e comprensión dos dous primeiros principios da Termodinámica e a súa aplicación a sistemas abertos, tomando como exemplos algúns sistemas aeroespaciais típicos.	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8
RA3: Coñecemento, comprensión e aplicación das relacións termodinámicas xeneralizadas, do equilibrio e estabilidade de sistemas simples compresibles e dos cambios de fase.	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8

Contidos

Topic

Propiedades de equilibrio e procesos entre estados de equilibrio.	Enerxía e entropía. Variables extensivas e intensivas. Procesos cuasiestáticos. Traballo presión-volumen. Primeiro Principio: traballo adiabático e calor. Ecuación de estado e coeficientes volumétricos. Calor específico e capacidade calorífica molar. Apéndice: transferencia de calor.
Segundo Principio e máquinas térmicas.	Fontes de calor e traballo. Segundo Principio da Termodinámica. Irreversibilidade térmica e ciclo de Carnot. Formulación moderna do Segundo Principio. Apéndice: motores térmicos, refrixeradores e bombas de calor.
Relacións formais.	Potencial químico. Ecuacións de Euler e de Gibbs-Duhem. Potenciais termodinámicos. Segundo Principio e enerxía libre. Apéndice: elasticidad, superficies e sistemas eléctricos e magnéticos.
Transicións de fase.	Gases reais, líquidos e ecuación de estado de van der Waals. Coexistencia de fases e regra das fases de Gibbs. Diagramas de fase. Tercer Principio. Apéndice: transición ferromagnético-paramagnético.
Termofluídica.	Volúmenes de control. Conservación da masa. Traballo de fluxo e enerxía dun fluido 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	19	43.5	62.5
Seminario	20	44	64
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. Favorecerase a participación activa do estudantado.
Seminario	O/a profesor/a adicará cara hora de clase a complementar as sesións maxistrais e á resolución de exercicios. Favorecerase a participación activa do estudantado.
Prácticas de laboratorio	De xeito simultáneo ao desenrolo dos contidos de teoría e problemas nas sesións maxistrais e seminarios, 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	Evaluated Competencess		
Lección maxistral	Realizarase unha proba escrita durante o desenvolvemento das clases. Dita proba celebrarase conxuntamente coa relativa aos seminarios e será liberatoria para o estudantado que acade unha cualificación superior a 7 puntos sobre 10.	20	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8
Seminario	Realizarase unha proba escrita durante o desenrolo das clases. Dita proba celebrarase conxuntamente coa relativa ás sesións maxistrais e será liberatoria para o estudantado que acade unha cualificación superior a 7 puntos sobre 10.	20	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8

Prácticas de laboratorio	A evaluación será levada a cabo no laboratorio.	10	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8
Exame de preguntas de desenvolvemento	Realizarase unha proba escrita sobre a totalidade dos contidos na data oficial de exame.	50	CG2	CE8 CE16 CE19	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

Avaliación de decembro/xaneiro: requerirase, en primeiro lugar, obter unha cualificación superior a 5 puntos sobre 10 na valoración conxunta do exame celebrado durante o desenrolo das clases e o exame na data oficial. En segundo lugar, esixirase obter unha cualificación superior a 5 puntos sobre 10 na parte de laboratorio. A cualificación final obterase consonte ás porcentaxes indicadas. No caso de que a nota ponderada supere un 5 sin que o fagan individualmente as notas relativas a teoría e seminarios e a laboratorio, a cualificación outorgada será 4,9.

Avaliación de xuño/xullo: requerirase obter unha cualificación superior a 5 puntos sobre 10 nunha proba única sobre a totalidade dos contidos (teoría, problemas e laboratorio) a celebrar na data oficial de exame.
Avaliación para non asistentes: requerirase obter unha cualificación superior a 5 puntos sobre 10 nunha proba única sobre a totalidade dos contidos (teoría, problemas e laboratorio) a celebrar na data oficial de exame.
O calendario de probas de avaliación aprobado oficialmente pola Xunta de Centro da EEAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

Bibliografía. Fontes de información

Basic Bibliography

J. F. Tester, M. Modell, **Thermodynamics and Its Applications**, 3ª ed., Prentice Hall, 1996

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

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

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

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

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

Complementary Bibliography

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

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

Recomendacións

Subjects that continue the syllabus

Mecánica de fluídos/O07G410V01402

Subjects that it is recommended to have taken before

Física: Física I/O07G410V01103

Plan de Continxencias

Description

En caso de alerta sanitaria provocada polo covid-19, terase en conta o seguinte:

- A docencia de aula e de laboratorio así como as tutorías están planificadas para migrar se fose necesario a 100% virtual.

- As probas de avaliación realizaranse de forma virtual empregando as ferramentas de Moovi e Campus Remoto.

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

Competencias	
Code	
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE11	Comprender as prestacións tecnolóxicas, as técnicas de optimización dos materiais e a modificación das súas propiedades mediante tratamentos.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe			
Learning outcomes	Competences		
RA1: Coñecemento, comprensión, aplicación e análise das propiedades, transformacións e tratamentos dos materiais e a súa aplicación en enxeñaría especialmente no ámbito Aeroespacial.	CG1	CE11 CE18 CE19	CT1 CT3 CT4 CT5 CT6 CT8 CT13
RA2: Coñecemento xeral dos distintos materiais metálicos utilizados na enxeñaría, como son os aceiros e as aliaxes lixeiras.	CG1	CE11 CE18 CE19	CT1 CT3 CT4 CT5 CT6 CT8 CT13

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

Contidos	
Topic	
Tema 1.Introdución	Introdución a ciencia dos materiais. Relación entre estructura e propiedades dos materiais. Tipos de materiais.
Tema 2. Propiedades mecánicas básicas.	Tracción, compresión, dureza, tenacidad. 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: dislocaciones. Dislocaciones e deformación plástica. Deformación por maclado. Endurecemento por acritude. Endurecemento por redución do tamaño de gran. Endurecemento por solución sólida. Defectos interfaciales: límite de gran. Defectos volumétricos.
Tema 5. Diagramas de fase.	Solidificación. Nucleación homoxénea e heteroxénea. Crecemento. Curva de enfrimiento. Estrutura de lingote. Defectos de solidificación. Diagramas de fase. Definicións e conceptos fundamentais. Sistemas isomorfos. Sistemas eutécticos. Interpretación de diagramas de fase. Desenvolvemento de microestructuras. Fases intermedias. Reaccións peritéctica e eutectoide. Diagrama Fe-C
Tema 6. Aliaxes férreas é tratamentos térmicos.	Aleacións férreas: aceiros e fundicions. Cambios na microestrutura e nas propiedades das aleacións Fe-C. Solidificación fora 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 polimeros. Cristalinidade. Comportamento térmico: fusión e transición vitrea. Comportamento mecánico. Viscoelasticidade. Conformado.
Tema 9. Materiais cerámicos.	Silicatos. Comportamento tensión-deformación. Refractarios. Abrasivos. Cerámicas avanzadas. Vidrios. Vitrocerámicas. Conformado e procesado de cerámicas.
Tema 10. Materiais compostos.	Clasificación en base á matriz e tipos de reforzo. Materiais compostos reforzados con fibras. Características xeráis.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	23	57.5	80.5
Resolución de problemas	11	20.5	31.5
Prácticas de laboratorio	15	19.5	34.5
Exame de preguntas obxectivas	2.5	0	2.5

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

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

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas	Ao longo do curso realizásense probas que consistirán en exercicios prácticos e test para avaliar o aprendizaxe do estudante nas sesións prácticas/teóricas.	20	CG1	CE11 CE18 CE19	CT1 CT3 CT4 CT5 CT6 CT8 CT13
Prácticas de laboratorio	Valorásense a entrega de informes do contido desenvolvido en practícalas de laboratorio.	10	CG1	CE11 CE18 CE19	CT1 CT3 CT4 CT5 CT6 CT8 CT13
Exame de preguntas obxectivas	Proba de avaliación. A proba constará de preguntas de resposta curta, problemas e/ou preguntas tipo test.	70	CG1	CE11 CE18 CE19	CT1 CT3 CT4 CT5 CT6 CT8 CT13

Other comments on the Evaluation

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

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

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===

Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

* Metodoloxías docentes que se modifican:

A docencia non presencial terá lugar mediante actividades síncronas e asíncronas reforzando tanto o emprego da plataforma Moovi como o uso das Aulas Virtuais do Campus Remoto, de xeito que o alumnado poida acadar sen problema as competencias prefixadas, co menor cambio posible respecto á docencia presencial.

* Mecanismo no presencial de atención al alumnado (tutorías):

As titorías realizaránse a través dos medios telematicos dispoñibles na Universidade de Vigo empregando de xeito preferente o despacho virtual do profesor da materia.

* Modificacions (se proceden) dos contidos a impartir:

No se contemplan modificacións nos contidos xerais da materia.

* Bibliografía adicional para facilitar a auto-aprendizaxe:

Ademáis das fontes de información reflectidas na quía docente, incluirase material de consulta adicional como extractos de capítulos de libros así como distintos enlaces de contido audiovisual relacionados con cada tema para complementar a información aportada en cada tema.

=== ADAPTACIÓN DE LA EVALUACIÓN ===

Debido a imposibilidade de garantir a posibilidade de realizar probas presenciais durante o curso, realízase unha modificación do sistema de avaliación da guía docente, co obxectivo de poder realizar o 100% da avaliación da materia mediante probas de carácter non presencial. Éstas realizaranse por medio de distintos medios telemáticos disponibles ao longo do cuadrimestre.

Sistema de evaliación modificado:
Informe de prácticas entregado de xeito individual cun peso do 10% na nota final.

Cuestionarios ou resolución de problemas de prácticas de xeito individual con 20% na nota final.

Cuestionarios o resolución de problemas de contidos teóricos, realizados de xeito individual cun 10% na nota final.

Examen final de preguntas obxetivas cun 60% na nota final.

O estudiante que renuncie á avalición continua mediante ás distintas probas de avalición, terá dereito á realización dunha proba final onde poderá acadar o 100% da calificación total da materia.

* Información adicional

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

Para aprobar a materia nesta convocatoria será necesario acadar como mínimo o 40% da nota máxima en cada unha das probas avaliadas. De non alcanzarse dito 40% nalgunha proba, a nota final estará limitada por 4.9

IDENTIFYING DATA

Classical mechanics

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

Competencies

Code	
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE15	Appropriate knowledge applied to engineering: Principles of the mechanics of continuous media and techniques for the calculation of their responses.
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.
CT1	Capability of analysis, organization and planification.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning

Learning outcomes

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

Contents

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

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	29	36	65
Project based learning	0	2	2
Seminars	8	31.5	39.5
Problem solving	0	20	20
Laboratory practical	12	8	20
Essay questions exam	2.5	0	2.5

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

Methodologies

	Description
Introductory activities	The first day, the professor will explain the fundamental aspects of the subject and its role in the course
Lecturing	The most relevant parts of the course shall be taught in one-hour sessions. Active participation of students will be welcome
Project based learning	Some aspects of the subject shall be studied by the student using specific teaching methodologies.
Seminars	Professor and students will solve exercises and problems during seminars.
Problem solving	Students will solve problems and exercises independetly
Laboratory practical	Once development of parts devoted to theory and exercises is finished, students will enter the laboratory under teacher's supervision. Student's autonomy will be encouraged.

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Lecturing	An exam will be held during classes, jointly with that relative to seminars.	25	CG1 CG2	CE15 CE19	CT1 CT3 CT4 CT5 CT6 CT8
Seminars	An exam will be held during classes, jointly with that relative to master sessions.	25	CG1 CG2	CE15 CE19	CT1 CT3 CT4 CT5 CT6 CT8
Laboratory practical	Performance in the laboratory will be assessed	10	CG1 CG2	CE15 CE19	CT1 CT3 CT4 CT5 CT6 CT8
Essay questions exam	Realization of an exam over the whole course contents in the official date.	40	CG1 CG2	CE15 CE19	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

To go further in December/January, one of the following options must be fulfilled: i) a qualification greater than 5 (over 10) in the exam during classes and in the official exam over the rest of subject contents or ii) a qualification greater than 5 (over 10) in the official exam over all the subject contents . Secondly, a qualification greater than 5 (over 10) will also be required for the laboratory part. These thresholds being overcame, the final qualification will be obtained according to the balance indicated above. If these thresholds were not overcome but the final qualification was higher than 5, then the student fail the subject with a qualification of 4.9.

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

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

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

Sources of information

Basic Bibliography

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

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

Recommendations

Subjects that continue the syllabus

Fluid mechanics/O07G410V01402

Resistance of materials and resilience/O07G410V01405

Subjects that it is recommended to have taken before

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

Contingency plan

Description

In the event of a health alert caused by COVID-19, the following is established:

Theoretical and practical teaching and tutoring for students are planned to migrate if necessary to 100% virtual teaching, without the need for a physical presence in the classroom.

The assessment tests are carried out virtually using the FAITIC and Remote Campus tools. The assesment details described in step 7 holds in this situation.

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

Competencias	
Code	
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE1	Capacidade para a resolución dos problemas matemáticos que poidan exporse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecemento, comprensión e aplicación de modelos estatísticos usados no ámbito da Enxeñaría.	CG2	CE1	CT1 CT3 CT5 CT8
Coñecemento, comprensión e aplicación das leises do cálculo de probabilidades e das variables aleatorias tanto unidimensionais coma n-dimensionais.	CG2	CE1	CT1 CT4 CT5 CT6 CT8
Coñecemento, compresión e aplicación da teoría de mostraxe, da teoría da decisión e dos modelos de regresión.	CG2	CE1	CT1 CT5 CT8

Contidos	
Topic	
Teoría de Probabilidade. Axiomática.	Espacio mostral, sucesos e probabilidade, combinatoria. Probabilidade condicionada, independencia de sucesos Regra do producto, Probabilidades totais e Teorema de Bayes

Variables aleatorias	Variables aleatorias unidimensionais e bidimensionais: medidas características. Principais v. aleatorias discretas Principais v. aleatorias continuas
Mostraxe e Inferencia estatística	Introducción á inferencia estatística Estimación puntual e por intervalos Contraste de hipóteses paramétricas Contrastes non paramétricos: de bondade de axuste, contrastes de posición, contrastes de independencia, contrastes de homoxeneidade
Regresión	Introdución os modelos de regresión. Regresión lineal simple: estimación, axuste e predición Regresión lineal múltiple

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	18	38	56
Resolución de problemas	14.5	42.5	57
Prácticas con apoio das TIC	15.5	18	33.5
Práctica de laboratorio	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	Actividades encamiñadas a tomar contacto e reunir información sobre o alumnado, así como a presentar a materia.
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas, exercicios ou prácticas a desenvolver polo estudante.
Resolución de problemas	Resolución de problemas, lecturas, resumenes, esquemas e cuestións de cada un dos temas do programa da materia. Resolución dos exercicios na pizarra. Farase uso do software estatístico libre R
Prácticas con apoio das TIC	Resolución dos exercicios coa axuda do ordenador. Farase uso do software estatístico libre R

Atención personalizada

Methodologies	**Description**
Lección maxistral	Atención e resolución de dúbidas ao estudantado en relación as diferentes actividades da materia. As sesións de titorización poderanse realizar por medios telemáticos (correo electrónico, videoconferencia, ...) baixo a modalidade de concertación previa.
Resolución de problemas	Atención e resolución de dúbidas ao estudantado en relación as diferentes actividades da materia. As sesións de titorización poderanse realizar por medios telemáticos (correo electrónico, videoconferencia, ...) baixo a modalidade de concertación previa.
Prácticas con apoio das TIC	Atención e resolución de dúbidas ao estudantado en relación as diferentes actividades da materia. As sesións de titorización poderanse realizar por medios telemáticos (correo electrónico, videoconferencia, ...) baixo a modalidade de concertación previa.

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas	Realizaranse probas escritas e/ou traballos para avaliar a resolución de exercicios e/ou problemas de forma autónoma así como a participación activa.	50	CG2	CE1	CT1 CT3 CT4 CT5 CT6 CT8
Prácticas con apoio das TIC	Realizaranse probas parciais ao longo do cuadrimestre, coas que se pretende comprobar se o alumno vai alcanzando as competencias básicas desta materia.	50	CG2	CE1	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

CRITERIOS DE AVALIACIÓN CONTINUA NA 1ª OPORTUNIDADE:

Para que un estudante aprobe a materia na primeira oportunidade, debe obter unha nota mínima de 5 puntos ao sumar as diferentes notas ponderadas, sempre e cando a nota de cada proba non sexa inferior a 3.5 sobre 10. En caso de non acadar nalgunha proba a nota mínima de 3.5, a nota resultante será o mínimo da media ponderada das notas acadadas e 3.5.
Un estudante debe seguir a avaliación continua cando se presente a algunha das probas parciais e deberá de seguir o procedimiento de avaliación descrito anteriormente. A duración máxima de cada proba será de 3 horas.

As probas parciais serán despois da finalización de cada tema.

Na proba final da 1ª oportunidade, os estudantes poderán recuperar as notas parciais.

Todo estudante por avaliación continua terá nota numérica final seguindo o procedemento anteriormente descrito.

A probas de avaliación continua realizáranse dentro do horario lectivo.

CRITERIOS DE AVALIACIÓN NON CONTINUA:

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

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

CRITERIOS DE AVALIACIÓN CONTINUA E NON CONTINUA NA 2ª OPORTUNIDADE E EXTRAORDINARIA (FIN DE CARREIRA):

O sistema de avaliación na 2ª oportunidade e Extraordinaria para todo o estudantado (con avaliación continua/non continua ou sen avaliar na 1ª oportunidade) será o mesmo que o empregado na 1ª oportunidade para estudantes sen avaliación continua.

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

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, 2020

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

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

Ademáis espérase que o estudantado presente un comportamento ético axeitado. O plaxio considerase como un comportamento deshonesto grave. En caso de detectar un comportamento ético non axeitado en calqueira das súas modalidades (copia, plaxio, utilización de aparellos electrónicos non autorizados, ...) considerarase que o/a alumno/a non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0) e o feito será comunicado á dirección do Centro para os efectos oportunos.

Plan de Continxencias

Description

Por causas derivadas de situacións vinculadas con posibles restriccións por razóns sanitarias ou similares, esta guía contempla as modificacións para o seguinte escenario:

MODALIDADE NON PRESENCIAL

- As clases serán impartidas de forma presencial a través de Campus Remoto e co apoio da plataforma moovi seguindo as directrices establecidas pola UVigo e sen prexuízo doutras medidas que se poidan adoptar para garantir a accesibilidade do alumnado aos contidos docentes. Respetarase a metodoloxía e avaliación recollida nesta guía.

- Estableceranse mecanismo alternativos (documentación adicional para traballo autónomo e asíncrono) no caso de que por parte do alumnado se teña problemas de conciliación e/ou conectividade.

- Atención ao Alumnado:
Contemplase que as sesións de titorización se realizán por medios telemáticos (correo electrónico, videoconferencia) baixo a modalidade de concertación previa.

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

Competencias	
Code	
CE16	Coñecemento adecuado e aplicado á Enxeñaría de: Os conceptos e as leis que gobernan os procesos de transferencia de enerxía, o movemento dos fluídos, os mecanismos de transmisión de calor e o cambio de materia e o seu papel na análise dos principais sistemas de propulsión aeroespaciais.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CE28	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en calquera réxime e determinan as distribucións de presións e as forzas aerodinámicas.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

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

Contidos	
Topic	
Introdución	Tema 1. Introdución: Conceptos fundamentais da Mecánica de Fluídos. Sólidos, líquidos e gases. Os fluídos como medios continuos. Equilibrio termodinámico local. Partícula fluída. Velocidade, densidade e enerxía interna específica. Viscosidade. Magnitudes fluídas intensivas e extensivas. Ecuacións de estado.

Balances de masa, cantidade de movemento e enerxía	Tema 2. Cinemática de Fluídos: Descricións Lagrangiana e euleriana. Liñas, superficies e volumes fluídos. Traxectorias e sendas. Liñas de traza. Liñas superficies e tubos de corrente. Puntos de remanso. Derivada substancial. Aceleración. Movementos estacionarios e uniformes. Velocidade normal de avance dunha superficie. Fluxo convectivo. Derivación de integrais estendidas a volumes fluídos. Teorema do transporte de Reynolds. Sistemas abertos e sistemas pechados. Movemento relativo na contorna dun punto. Circulación. Movementos irrotacionais. Teorema de Bjerknes-Kelvin. Tensor de velocidades de deformación. Tema 3. Ecuacións Xerais: Principio de conservación da masa. Ecuación da continuidade en forma integral. Ecuación da continuidade en forma diferencial. Función de corrente e función material. Ecuación de cantidade de movemento. Forzas de longo alcance. Forzas de superficie ou de curto alcance. Tensor de esforzos. Ecuación da cantidade de movemento en forma integral. Ecuación da cantidade de movemento en forma diferencial. Lei de Navier-Poisson. Tensor de esforzos viscosos. Ecuación da enerxía en forma integral. Fluxo de calor por condución. Forma diferencial da ecuación da enerxía. Lei de Fourier. Fluxo de calor por condución. Resumo das ecuacións de Mecánica de Fluídos. Condicións iniciais. Condicións de contorno máis usuais. Condición de non escorredura.
Fluidostática	Tema 4. Fluidostática: Ecuacións xerais. Condicións de equilibrio. Función potencial de forzas másicas. Enerxía potencial e principio de conservación da enerxía. Sondas de presión estática. Hidrostática. Equilibrio de gases. Atmosfera estándar
Análise Dimensional e Semellanza Física	Tema 5. Análise Dimensional e Semellanza Física: Teorema Pi de Vaschy-Buckingham. Solucións de semellanza. Semellanza física. Números adimensionais en Mecánica de Fluídos
Movementos laminares e turbulentos en tubos.	Tema 6. Movemento laminar unidireccional de fluídos incompresibles: Corrente de Couette. Corrente de Poiseuille. Movemento laminar en tubos. Perdas de carga en réxime laminar. Factor de fricción. Efecto da entrada. Tema 7. Movemento a baixos números de Reynolds. Ecuacións. Condicións iniciais e de contorno. Aplicación a fluídos incompresibles. Movementos ao redor dun cilindro e unha esfera. Lubricación: Ecuación de Reynolds da lubricación 3D. Aplicacións. Cojinete cilíndrico, lubricación con gases, patín rectángular, outras. Tema 8. Movemento turbulento en tubos: Introdución ao movemento turbulento de fluídos incompresibles en tubos. Inestabilidade do fluxo laminar en tubos. Perdas de carga en réxime turbulento. Factor de fricción. Diagrama de Moody
Introdución a fluídos ideais.	Tema 9. Fluídos ideais. Ecuacións de Euler: Introdución. Fluxos a altos números de Reynolds. Ecuación de Bernoulli. Sondas Pitot. Condicións de remanso. Movemento case estacionario.

Prácticas de laboratorio	Resolución de problemas dos temas expostos en Aula. Ensaio en banco aerodinámico: Visualización de fluxos a baixos números de Reynolds. Visualización de rúas de Karman tras distintos obxectos romos. Observación de cambios de frecuencia do ronsel. Separación de capa límite. Transición de fluxo laminar a fluxo turbulento. Comprobación da ecuación de Bernoulli. Ensaio en túnel de vento: Medición con sonda de Prandtl, toma estática, forzas sobre corpos romos ou aerodinámicos

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30	60	90
Resolución de problemas	10	10	20
Prácticas de laboratorio	2	2	4
Resolución de problemas de forma autónoma	0	20	20
Exame de preguntas obxectivas	2	5	7
Resolución de problemas e/ou exercicios	5	0	5
Informe de prácticas, prácticum e prácticas externas	1	3	4

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

Metodoloxía docente

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

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess	
Lección maxistral	repartirase unha folla con preguntas teóricas curtas, sobre a materias da lección maxistral	5	CE16 CE18 CE19 CE28	CT1 CT3 CT6 CT8
Resolución de problemas	Entrega de problemas propostos na folla de actividade ou de forma directa nas clases prácticas	5	CE16 CE18 CE19 CE28	CT1 CT3 CT4 CT5 CT6
Prácticas de laboratorio	Asistencia e participación activa nas clases prácticas de laboratorio con entrega de informe sobre o realizado nas mesmas	5	CE16 CE18 CE19 CE28	CT1 CT3 CT4 CT6 CT8

Exame de preguntas obxectivas	Realizarase un exame escrito cara á metade do curso sobre o contido abordado nas sesións maxistrais e nas sesións de resolución de problemas até a data, cun peso do 20% da nota na materia.	20	CE16 CE18 CE19 CE28	CT1 CT3 CT4 CT5 CT6 CT8
Resolución de problemas e/ou exercicios	Realizarase un exame ao final do curso sobre o contido abordado nas sesións maxistrais cun peso do 10% e nas sesións de resolución de problemas, cun peso do 40% sobre a nota final na materia.	60	CE16 CE18 CE19 CE28	CT1 CT3 CT4 CT5 CT6 CT8
Informe de prácticas, prácticum e prácticas externas	Realizarase un informe tecnico sobre unha instalacion ou deseño de movemento de fluidos. O informe debe conter ademais un apartado de conclusións	5	CE16 CE18 CE19 CE28	CT1 CT3 CT4 CT5 CT6 CT8

Other comments on the Evaluation

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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

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

Recomendacións

Subjects that continue the syllabus

Mecánica de fluídos II e CFD/O07G410V01922

Subjects that are recommended to be taken simultaneously

Termodinámica/O07G410V01303

Subjects that it is recommended to have taken before

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

Other comments

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

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

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===

Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen.- Podería ser parte delas, se así se determina, pero en principio soio se manteñen as prácticas de laboratorio

* Metodoloxías docentes que se modifican.- Se modifican as clases de teoría (lecciónns maxistrales) e as clases de problemas prácticos

* Mecanismo non presencial de atención ao alumnado (titorías).- Pasan a ser virtuales a través da aula 16

* Modificacións (se proceder) dos contidos a impartir.- En principio non se modifican

* Bibliografía adicional para facilitar a auto-aprendizaxe. Se considera suficiente a recomendada

* Outras modificacións.- Podería darse o caso, por número de alumnos e aulas dispoñible que as clases de teoría tiveran que ser virtuais e as de problemas prácticos presenciais

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

Competencias	
Code	
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG4	Verificación e Certificación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE17	Coñecemento adecuado e aplicado á enxeñaría de: Os elementos fundamentais dos diversos tipos de aeronaves; os elementos funcionais do sistema de navegación aérea e as instalacións eléctricas e electrónicas asociadas; os fundamentos do deseño e construción de aeroportos e os seus diversos elementos.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

Resultados de aprendizaxe			
Learning outcomes	Competences		
RA1: Coñecemento e comprensión do funcionamento dos dispositivos electrónicos	CG1	CE17	CT1 CT4 CT5 CT8
RA2: Coñecemento da estrutura básica dos sistemas electrónicos baseados en circuítos dixitais e microprocesadores e a súa aplicación en enxeñaría aeroespacial.	CG1 CG4	CE17	CT1 CT4 CT5 CT8
RA3: Coñecemento xeral dos distintos tipos de sensores e sistemas electrónicos de acondicionamento e adquisición de datos no ámbito das aplicacións aeroespaciais.	CG1	CE17	CT4 CT5 CT8
RA4: Coñecemento da estrutura dos convertidores electrónicos de potencias e das fontes de alimentación.		CE17	CT1 CT4 CT5 CT8

RA5: Coñecemento xeral sobre o modelado dinámico de sistemas.	CG1	CE18	CT1 CT3 CT4 CT5 CT6 CT8
RA6: Coñecemento, análise e aplicación das accións básicas de control.	CG1	CE18	CT1 CT3 CT4 CT5 CT6 CT8
RA7: Coñecemento e comprensión sobre o deseño de reguladores no dominio da frecuencia.	CG1 CG4	CE18	CT1 CT3 CT4 CT5 CT6 CT8

Contidos	
Topic	
Tema 1: Dispositivos electrónicos	1.1 Diodos rectificadores, zener e emisores de luz 1.2 Transistores bipolares, funcionando nas zonas de corte e de saturación. 1.3 Transistores Mosfet, de canle N e de canle P (enhancement type), funcionando nas zonas óhmica e de corte. 1.4 Amplificadores operacionales. Conceptos básicos
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. Representación de funcións lóxicas. 2.4 Portas lóxicas básicas. Implementación de funcións lóxicas sinxelas. 2.5 Bloques funcionais combinacionales e secuenciales 2.6 Memorias semiconductoras. 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 3.4 Conceptos básicos sobre convertidores D/A
Tema 4: Convertidores de potencia e fontes de alimentación.	4.1 Tipos de convertidores. Características básicas 4.2 Deseño dunha fonte de alimentación lineal.
Tema 5: Modelos matemáticos dos sistemas físicos. Linealización.	
Tema 6: Funcións de transferencia. Diagrama de bloques.	
Tema 7: Estabilidade. Erros. Resposta estática e dinámica.	
Tema 8: Representacións de Bode e Nyquist.	
Tema 9: Accións de control. Deseño de Reguladores no dominio da frecuencia.	

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	37	25	62
Prácticas de laboratorio	13	20	33
Resolución de problemas de forma autónoma	0	50	50
Exame de preguntas de desenvolvemento	2.5	0	2.5
Informe de prácticas, prácticum e prácticas externas	0	2.5	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	En relación á parte I da materia nas clases de teoría impartense conceptos básicos sobre os temas 1 a 4. Para a exposición dos conceptos teóricos utilizarase tanto o proxector de vídeo como o encerado. O alumnado debe facer un traballo persoal posterior a cada clase repasando os conceptos expostos nas mesmas. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas clases de teoría exporanse ao alumnado os contidos desta parte da materia.
Prácticas de laboratorio	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), algunhas das clases de grupo reducido dedicaranse a facer prácticas no laboratorio de Electrónica. O resto das clases dedicaranse a resolver exercicios. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), nas prácticas de laboratorio se formularan, analizarán, resolverán e debaterán problemas relacionados coa temática desta parte da materia.
Resolución de problemas de forma autónoma	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), o longo do periodo de docencia se publicarán exercicios para ser feitos como actividades non presenciales. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía) en clase se exporán, analizarán e debateranse problemas e/ou exercicios relacionados coa temática desta parte da materia

Atención personalizada

Methodologies	Description
Lección maxistral	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas sobre ditos temas durante as clases de teoría así como durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e no seguinte ligazón: http://moovi.uvigo.gal. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.
Prácticas de laboratorio	En relación á parte I da materia (temas 1 a 4 indicados no apartado Contidos desta guía), o alumnado pode consultar calquera dúbida sobre as prácticas durante as clases de grupo reducido así como durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e no seguinte ligazón: http://moovi.uvigo.gal. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.
Resolución de problemas de forma autónoma	En relación aos temas 1 a 4 indicados no apartado Contidos desta guía, o alumnado pode consultar calquera dúbida sobre os exercicios a realizar como actividades non presenciais durante as horas destinadas a tutorías (despacho 312, edificio politécnico). O horario de titorías está publicado na porta do despacho 312 e no seguinte ligazón: http://moovi.uvigo.gal. En relación á parte II da materia (temas 5 a 9 indicados no apartado Contidos desta guía), o alumnado pode consultar as dúbidas ao profesorado da materia tanto durante as clases como en titorías.

Avaliación

	Description	Qualification	Evaluated Competencess
Lección maxistral	En relación á primeira parte da materia (temas 1 a 4 indicados no apartado Contidos desta guía), ao finalizar as clases realizarase un exame no que se exporán diversas cuestións e problemas sobre os contidos desta parte da materia. Devandito exame representa un 50% da nota final da materia. A cualificación deste exame así como a súa influencia na nota final detállase no apartado 'Outros comentarios sobre a Avaliación'. Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4. En relación á segunda parte da materia (temas 5 a 9 indicados no apartado Contidos desta guía), realizarase unha proba de resposta curta sobre as contidos/competencias/resultados de aprendizaxe dos GRUPOS GRANDES/AULA. Esta proba é obrigatoria e representa un 33% da nota final desta materia. A cualificación deste exame así como a súa influencia na nota final detállase no apartado Outros comentarios sobre a avaliación. Resultados avaliados da aprendizaxe: *RA5, *RA6 e *RA7.	83	CG1 CE17 CE18 CT1 CT3 CT6 CT8

Prácticas de laboratorio	En relación á primeira parte da materia (temas 1 a 4 indicados no apartado Contidos desta guía) faranse unha serie de prácticas. Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4 En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) realizarase 1 proba sobre as contidos/competencias/resultados de aprendizaxe das clases de GRUPOS REDUCIDOS/LABORATORIO. Esta proba corresponde a un 12% da nota final desta materia. Esta proba é obrigatoria. A cualificación deste exame así como a súa influencia na nota final detállase no apartado Outros comentarios e avaliación de Xullo. Resultados avaliados da aprendizaxe: *RA5, *RA6 e *RA7	12	CG1 CE17 CT1 CG4 CE18 CT3 CT4 CT5 CT6 CT8	
Resolución de problemas de forma autónoma	En relación aos temas 1 a 4 indicados no apartado Contidos desta guía, ao longo do período de docencia desta parte da materia publicaranse unha serie de exercicios e/ou problemas para facer como actividades non presensciais. Os resultados de aprendizaxe son: RA1, RA2, RA3 e RA4. En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) a realización de problemas e/ou exercicios valorarase cun máximo de 0.25 puntos na nota final. Resultados avaliados da aprendizaxe: *RA5, *RA6 e *RA7	2.5	CG1 CE17 CT1 CE18 CT3 CT4 CT5 CT6 CT8	
Informe de prácticas, prácticum e prácticas externas	En relación á segunda parte desta materia (temas 5 a 9 indicados no apartado Contidos desta guía) un informe de prácticas permitirá avaliar a asistencia e participación activa nas clases teóricas e prácticas e nas *tutorías. Resultados avaliados da aprendizaxe: *RA5, *RA6 e *RA7	2.5	CG1 CE17 CT1 CG4 CE18 CT3 CT4 CT5 CT6 CT8	

Other comments on the Evaluation

Esta materia consta de dúas partes. Na primeira parte (temas 1 a 4) ven conceptos básicos de Electrónica e na segunda parte (temas 5 a 9) ven conceptos sobre Regulación Automática. O peso de cada parte na nota final é dun 50%. Dado que as notas numéricas nas actas teñen que estar comprendidas entre 0 e 10 puntos [ver Real Decreto 1125/2003 do 5 de setembro (BOE do 18 de setembro) e o acordo do Consello de Goberno do 18/03/2004], cada parte da materia achega unha nota entre 0 e 5 puntos á nota final que se porá na acta. A nota final en calquera edición da acta (Maio, Xullo) obterase sumando as notas (entre 0 e 5 puntos) obtidas en cada unha das dúas partes da materia. Para poder aprobar a materia en calquera edición da acta (Maio, Xullo) será necesario obter unha nota mínima de 2,5 puntos (sobre 5 puntos) en cada unha das dúas partes. No caso de obter unha nota inferior a 2,5 puntos (sobre 5 puntos) nalgunha das partes, a nota final que figurará na acta será a suma das notas obtidas en ambas as partes limitándoa a un máximo de 4 puntos. O calendario de exames aprobado oficialmente pola Xunta do Centro da EIAE atópase publicado na páxina web http://aero.uvigo.es/gl/docencia/exames

PARTE I da materia (Electrónica):

Criterios de avaliación para asistentes, relativo aos temas 1 a 4, correspondentes á primeira edición da acta: na convocatoria de Maio, as competencias adquiridas, relativas aos temas 1 a 4, avalíanse mediante un exame escrito.

Cualificación: a nota correspondente á Parte I da materia será igual á nota que se obteña no exame. O exame valórase sobre 5 puntos, sendo necesario obter unha nota igual ou superior a 2,5 puntos para aprobalo.

Criterios de avaliación para non asistentes, relativo aos temas 1 a 4, correspondente á primeira edición da acta: as competencias adquiridas na convocatoria de Maio, avalíanse mediante un exame escrito no que se expoñen diversas cuestións e problemas sobre os temas 1 a 4. O exame farase o mesmo día, á mesma hora e no mesmo lugar que o exame indicado anteriormente para as persoas asistentes.

Cualificación: a nota correspondente á Parte I da materia será igual á nota que se obteña no exame. O exame valórase sobre 5 puntos, sendo necesario obter unha nota igual ou superior a 2,5 puntos para aprobalo.

Criterios de avaliación para asistentes e non asistentes, relativo aos temas 1 a 4, correspondente á segunda edición da acta: o sistema de avaliación consiste na realización dun exame escrito no que se expoñen diversas cuestións e problemas sobre os temas 1 a 4 indicados no apartado Contidos desta materia.

Cualificación: a nota correspondente á Parte I da materia será igual á nota que se obteña no exame. O exame valórase sobre 5 puntos, sendo necesario obter unha nota igual ou superior a 2,5 puntos para aprobalo. A nota obtida na convocatoria de Maio correspondente á parte I da materia non se garda para a convocatoria de Xullo, tanto no caso das persoas asistentes como das persoas non asistentes.

PARTE II da materia, AUTOMÁTICA:CRITERIOS DE AVALIACIÓN DA PARTE DE AUTOMÁTICA (VÁLIDOS PARA ASISTENTES E NON ASISTENTES, EN CALQUERA EDICIÓN DE ACTAS):
- Realización dunha proba de resposta curta relativa ás clases de grupo grande/teoría, valorada en 3.3 puntos. A duración desta proba será de 1.5 horas. Esíxese alcanzar un mínimo de 1.5 puntos.
- Realización dunha proba práctica relativa ás clases de grupo reducido/laboratorio, valorada en 1.2 puntos. A duración desta proba será de 1 hora (Esta proba realizarase para os alumnos asistentes nunha clase de grupo reducido durante a última semana de clases, e para os non asistentes despois da proba de resposta curta). Esíxese alcanzar un mínimo de 0.5 puntos.
- Resolución dunha serie de exercicios e/ou problemas propostos, valorados en 0.25 puntos.
- A asistencia e a participación activa nas clases valórase cun máximo de 0.25 puntos.

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

Notas para a parte de Electrónica:
_ As persoas que se presenten como non asistentes deben comunicalo por escrito ao profesor de teoría antes de que transcorran as 4 primeiras semanas do cuadrimestre. De non facelo así consideraranse como asistentes.

_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. Non se corrixirá ningunha resposta escrita a lapis nun exame

_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. Se durante un exame unha persoa utiliza ou ten á vista un teléfono móbil, non se lle corrixirá devandito exame e poñeráselle un cero como nota da 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, as prácticas e as titorías. Prohíbese fotografar o que escriba o profesor no encerado durante as clases.

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

James M. Fiore, **Amplificadores Operacionales y Circuitos Integrados**, Paraninfo, 2004

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

Louis Nashelsky Robert L. Boylestad, **Electronic Devices and Circuit Theory**, Pearson, 2014

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

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

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

Complementary Bibliography

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

John F. Wakerly, **Digital Design: Principles and Practices**, Pearson, 2005

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

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

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

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

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

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

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

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

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

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===

* Metodoloxías docentes que se manteñen: todas, excepto as prácticas de laboratorio de Electrónica

* Metodoloxías docentes que se modifican: as prácticas de laboratorio de Electrónica substituiranse por clases de problemas.

* Mecanismo non presencial de atención ao alumnado (*tutorías): Campus Remoto e Moovi

* Modificacións (si proceden) dos contidos a impartir: ningunha

* Bibliografía adicional para facilitar o auto-aprendizaxe: ningunha

=== ADAPTACIÓN DA AVALIACIÓN ===

* Probas xa realizadas: todas as probas realizadas manteñen o seu peso

* Probas pendentes que se manteñen: todas

* Probas que se modifican: non se modifica ningunha proba.

* Novas probas: ningunha

* Información adicional: debido á situación excepcional, ante a imposibilidade de poder facer as probas dun modo presencial, utilizaranse medios virtuais para a realización das probas. Utilizaranse os medios proporcionados pola Universidade, actualmente ou 'Campus Remoto' e Moovi. Tamén se poderán complementar con outros medios.

IDENTIFYING DATA				
Air transport and airborne systems				
Subject	Air transport and airborne systems			
Code	O07G410V01404			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Orgeira Crespo, Pedro			
Lecturers	Gómez San Juan, Alejandro Manuel Orgeira Crespo, Pedro			
E-mail	porgeira@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject is divided in two main areas. First, civil aerial transport fundamentals are introduced, as well as the regulatory laws, the elements that constitute it, and its interactions. Second, airborne systems are described. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CG7	Capability to analyze and assess the social and environmental impact of technical solutions.
CE14	Understand the air transport system and the coordination with other transport modes.
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.
CE21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.
CT1	Capability of analysis, organization and planification.
CT2	Leadership, initiative and entrepreneurship
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes			
Learning outcomes	Competences		
Knowledge of the structure and the elements that conform the current system of world-wide transport.		CE14	CT1 CT5 CT8
Knowledge the economic and social profits of the aerial transport	CG7	CE14 CE21	CT1 CT4 CT5 CT6 CT8 CT13
Understanding of the legal characteristics of the aerial transport and knowledge of this transport mode law	CG1 CG7	CE14 CE21	CT1 CT2 CT3 CT4 CT8 CT13

Knowledge of the different elements that integrate the system of transports: aerial companies, manufacturing, airports, aerial navigation suppliers	CG1 CG7	CE14 CE19	CT1 CT2 CT4 CT6 CT8 CT13
Comprise the most important aspects of the situation of the aerial transport in the actuality, so much in Spain how in the rest of the world	CG1 CG7	CE14 CE19 CE21	CT1 CT2 CT3 CT4 CT6 CT8 CT13
Knowledge of the different systems and subsystrems onboarded in aerospace vehicles	CG1 CG7	CE14 CE19 CE21	CT1 CT3 CT4 CT8 CT13
Knowledge of the way in which the aerial way inserts in the system of transport and the distinct forms of cooperation and intermodal competition	CG1	CE14	

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	38	68.5	106.5
Laboratory practical	12	14.5	26.5
Report of practices, practicum and external practices	2.5	14.5	17

*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	Evaluated Competencess		
Report of practices, practicum and external practices	Report covering all requirements given	20	CG1 CG7	CE14 CE19 CE21	CT1 CT2 CT3 CT4 CT5 CT6 CT8 CT13

Other comments on the Evaluation

First oportunity:

- 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 oportunity:

- Students who have not passed the subject in the first oportunity will take an extraordinary exam 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.

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

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 it is recommended to have taken before

Aerospace technology/O07G410V01205

Contingency plan

Description

The evaluation will be carried out, under normal conditions, under the indications reflected in this guide.

In the event of exceptional circumstances that impede the normal development of teaching, an online teaching will be chosen (whenever possible) via streaming (live), through the tools provided by the University of Vigo. The evaluation tests would be carried out, in this case, remotely with the tools of the University; the evaluation criteria will be maintained in non-classroom teaching, except for extraordinary reasons that totally prevent said option.

In the event that teaching is carried out in a mixed way, the evaluation criteria will be maintained as well, except for extraordinary reasons that make this option totally impossible. The evaluation tests would be carried out, in this case, remotely with the tools of the University.

In both cases, tutoring meetings will take place remotely via the tools provided by the University, in a moment subject to agreement between the teacher and the student.

Students who, in any of the three cases ("normal" teaching, 100% on-line, blended), do not attend the theory teaching sessions, do not attend 100% of the practical sessions, or do not deliver all of the the memories of practices / work in term surpassing in all a 4 over 10, will carry out a different examination both in the first edition in the second, with sections that complement the test of the students of continuous evaluation.

IDENTIFYING DATA				
Resistencia de materiais e elasticidade				
Subject	Resistencia de materiais e elasticidade			
Code	O07G410V01405			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Conde Carnero, Borja			
Lecturers	Bendaña Jácome, Ricardo Javier 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.			

Competencias	
Code	
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG4	Verificación e Certificación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE7	Comprender o comportamento das estruturas ante as solicitacións en condicións de servizo e situacións límite.
CE15	Coñecemento adecuado e aplicado á Enxeñaría de: Os principios da mecánica do medio continuo e as técnicas de cálculo da súa resposta.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT1	Capacidade de análise, organización e planificación
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico

Resultados de aprendizaxe			
Learning outcomes	Competences		
Comprensión, análise e cálculo de problemas sinxelos de elementos estruturais baixo comportamento lineal	CG1	CE7 CE15 CE18 CE19	CT1 CT4 CT5 CT8
Comprensión da teoría básica e da solución de algúns problemas fundamentais en elasticidade lineal de sólidos	CG1 CG4	CE7 CE15 CE18 CE19	CT1 CT3 CT4 CT5 CT8

Coñecemento, comprensión e aplicación dos métodos de cálculo	CG1 CG2 CG4	CE7 CE15 CE18 CE19	CT1 CT3 CT4 CT5 CT8
Aplicación, análise e síntese de estruturas	CG1 CG2 CG4	CE7 CE15 CE18	CT1 CT3 CT4 CT5 CT6 CT8

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	32	60	92
Prácticas de laboratorio	18	37.5	55.5
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
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	Evaluated Competencess		
Prácticas de laboratorio	Asistencia e participación activa nas clases prácticas. Resolución de problemas e/ou exercicios de forma autónoma.	10	CG1 CG2 CG4	CE7 CE15 CE18 CE19	CT1 CT3 CT4 CT5 CT8
Exame de preguntas de desenvolvemento	Exame dos contidos de toda a materia.	90		CE7 CE15 CE18 CE19	CT1 CT3 CT5 CT8

Other comments on the Evaluation

Estudantes que renuncian oficialmente á avaliación continua

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

Prácticas de laboratorio

A parte presencial correspondente a cada práctica realízase nunha data específica, polo que non é posible recuperar as faltas de asistencia.

Excusaránse puntual e excepcionalmente as prácticas non realizadas nas que o alumno 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

Espérase que o alumno presente un comportamento ético axeitado. No caso de detectar un comportamento non ético (copia, plaxio, uso de dispositivos electrónicos non autorizados e outros) consideraráse que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso, a nota global no curso académico actual será de suspenso (0,0).

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, **Cálculo matricial de estructuras**, Coleg. Ofic. Ing. Tec. Obras Publicas, 1999

Complementary Bibliography

J. A. González Taboada, **Fundamentos y problemas de tensiones y deformaciones en materiales elásticos**, Tórculo, 2008

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen

Lección maxistral: Exposición da teoría básica da materia.
Prácticas: Resolución de problemas relacionados cos contidos teóricos.
Ambas metodoloxías serán adaptadas a un contexto de docencia non presencial a tráves do uso de ferramentas de teledocencia dispoñibles na Universidade de Vigo (Moovi, Campus Remoto ou outros).
Primarase a impartición dos contidos teóricos por medios telemáticos así como aqueles contidos de prácticas de resolución de problemas, aula de informática, e outros, que poidan ser virtualizados ou desenvolvidos polo alumnado de xeito guiado.

* Mecanismo non presencial de atención ao alumnado (titorías)

As titorías serán atendidas no espacio temporal habitual a través de medios telemáticos ordinarios (correo electrónico, Moovi) así como dos despachos virtuais do profesorado dispoñibles no Campus Remoto da Universidade de Vigo.

=== ADAPTACIÓN DA AVALIACIÓN ===

* Probas pendentes que se manteñen
Exame de preguntas de desenvolvemento: [Peso anterior 90%] [Peso Proposto 90%]

* Probas que se modifican
[Prácticas de laboratorio: Asistencia e participación activa nas clases prácticas. (5%) Resolución de problemas e/ou exercicios de forma autónoma. (5%)]
=>
[Resolución de problemas e/ou exercicios de forma autónoma.
(10%)]

As probas de avaliación desenvolveranse de forma presencial salvo Resolución Reitoral que indique que se deben facer de forma non presencial, realizándose dese xeito a través das distintas ferramentas postas a disposición do profesorado. Aquelas probas non realizables de forma telemática se suplirán por outras (entregas de traballo autónomo guiado, etc.)

IDENTIFYING DATA				
Fabricación aeroespacial				
Subject	Fabricación aeroespacial			
Code	O07G410V01501			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	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.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE12	Comprender os procesos de fabricación.
CT2	Liderado, iniciativa e espírito emprendedor
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT9	Capacidade de traballo en equipo de carácter interdisciplinar
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe				
Learning outcomes	Competences			
Interpretación, confección e xestión de documentos técnicos, para o deseño conceptual, preliminar e detalle de modelos físicos e sistemas.	CB2 CB3 CB5	CG1 CG2	CE12	CT2 CT3 CT4 CT8 CT11 CT13
Coñecemento dos principios xerais sobre deseño xeométrico, funcional e os específicos dos elementos e instalacións propias das especialidades.	CB2 CB3 CB5	CG1 CG2	CE12	CT2 CT3 CT4 CT8 CT11 CT13

Criterios de calidade e análise destes deseños. O estudante coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación.	CB2 CB3 CB5	CG1 CG2	CE12	CT2 CT3 CT4 CT6 CT8 CT9 CT11 CT13
O estudante coñece toda a información necesaria para levar a cabo un proceso de produción.	CB2 CB3 CB5	CG1 CG2	CE12	CT2 CT3 CT4 CT8 CT11 CT13
O estudante é capaz de realizar un informe que permita a execución exitosa dun proceso de produción.	CB2 CB3 CB5	CG1 CG2	CE12	CT2 CT3 CT4 CT8 CT11 CT13

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 ensamblaxe 10. Metroloxía
Bloque II	Simulación de procesos de fabricación

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	17	36	53
Resolución de problemas	14	21.5	35.5
Aprendizaxe colaborativa	1	2	3
Prácticas con apoio das TIC	15	35	50
Prácticas de laboratorio	3	3	6
Resolución de problemas e/ou exercicios	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.
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/dos 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	Introducción ó traballo con equipos de fabricación no laboratorio.

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.

Avaliación

	Description	Qualification	Evaluated Competencess		
Lección maxistral	Proba escrita	70	CB2 CB5	CE12	CT4 CT8
Resolución de problemas	Entrega de problemas propostos resoltos	5	CB2 CB5	CE12	CT2 CT3 CT4 CT8
Aprendizaxe colaborativa	Participación en actividades propostas	5	CB2 CB3 CB5	CE12	CT2 CT3 CT4 CT6 CT8 CT9 CT13
Prácticas con apoio das TIC	Entrega de memorias de prácticas	20	CB2 CB5	CE12	CT2 CT3 CT4 CT8 CT11

Other comments on the Evaluation

PRIMEIRA OPORTUNIDADE:

A materia avalíase en base a catro parámetros:

-Exame de teórico-práctico (nota máxima 7 puntos). Nesta proba avalíanse os coñecementos teóricos da materia e cuestións relacionadas cos problemas mediante un exame tipo test na data establecida para o exame oficial da materia.

-Resolución de problemas (nota máxima 0,5 puntos). Avaliarase a entrega da resolución aos problemas expostos durante o curso nos prazos establecidos.

-Aprendizaxe colaborativo (nota máxima 0,5 puntos). Deberase participar nas actividades propostas durante o curso. Este apartado será avaliado en grupo.

-Prácticas (nota máxima 2 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 exame teórico-práctico a nota sexa inferior a 4,5, sendo a nota final de actas a nota do examen.

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 se gardará a cualificación do exame.

OUTRAS CONSIDERACIÓNS:

En caso de detección de 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.

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

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

Bibliografía. Fontes de información

Basic Bibliography

S. Kalpakjian, S.R. Schmid, **Manufacturing engineering and technology**, 7, Pearson Education, 2014

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

J.T. Black, Ronald A. Kohser, **DeGarmo s Materials and Processes in Manufacturing**, 12, Wiley, 2017

Complementary Bibliography

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

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

Recomendacións

Subjects that continue the syllabus

Tecnoloxías para conformado de materiais aeroespaciais/O07G410V01913

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen
Todas se manteñen en formato asíncrono ou síncrono a distancia. Para iso empregaranse os medios dispostos pola Universidade de Vigo: Campus Remoto e/ou MOOVI.

* Mecanismo non presencial de atención ao estudantado (titorías)
Desenvolveranse mediante email ou videoconferencia en despacho virtual.

=== ADAPTACIÓN DA AVALIACIÓN ===
* Información adicional
A avaliación mantense sen cambios en calquera circunstancia.
No escenario multimodal e/ou non presencial, cando cumpra, o persoal docente implicado na impartición da docencia resérvase o dereito de non dar o consentimento para a captación, publicación, retransmisión ou reprodución do seu discurso, imaxe, voz e explicacións de cátedra, no exercicio das súas funcións docentes, no ámbito da Universidade de Vigo.

IDENTIFYING DATA				
Dirección e xestión de proxectos				
Subject	Dirección e xestión de proxectos			
Code	O07G410V01701			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Rey González, Guillermo David			
Lecturers	Gómez San Juan, Alejandro Manuel 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.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG4	Verificación e Certificación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG5	Capacidade para levar a cabo actividades de proxección, de dirección técnica, de peritación, de redacción de informes, de ditames, e de asesoramento técnico en tarefas relativas á Enxeñaría Técnica Aeronáutica, de exercicio das funcións e de cargos técnicos genuinamente aeroespaciais.
CG7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.
CG8	Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Aeronáutico.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT2	Liderado, iniciativa e espírito emprendedor
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT9	Capacidade de traballo en equipo de carácter interdisciplinar
CT10	Capacidade de tratar e actuar en situacións de conflitos e negociación
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
CT12	Compromiso ético e democrático
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe

Learning outcomes	Competences			
Coñecemento, comprensión, análise e síntese da xestión económica dunha empresa e da xestión de proxectos	CB2 CB3 CB4 CB5	CG1 CG2 CG4 CG5 CG8	CE19	CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT11
Coñecemento dos determinantes do impacto ambiental do sector aeronáutico	CB2 CB3 CB4 CB5	CG1 CG2 CG7 CG8	CE19	CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT11 CT12 CT13

Contidos
Topic
Tema 1. Dirección empresarial: función directiva. Xestión de recursos humanos e do coñecemento.
Tema 2. Xestión de Calidade. Xestión de Mercadotecnia.
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	31	63	94
Aprendizaxe baseado en proxectos	10	16.5	26.5
Estudo de casos	9	18	27
Exame de preguntas obxectivas	2	0	2
Presentación	0.5	0	0.5

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

Metodoloxía docente	
	Description
Lección maxistral	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	Evaluated Competencess			
Aprendizaxe baseado en proxectos	Realización dun proxecto relacionado co contido da materia	30	CB2 CB3 CB4 CB5	CG1 CG2 CG4 CG5 CG7 CG8	CE19	CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT11
Estudo de casos	Resolución de problemas e casos prácticos expostos nas sesións de prácticas	15	CB2 CB3 CB5	CG1 CG2 CG4 CG5 CG7 CG8	CE19	CT3 CT4 CT5 CT8 CT11 CT13
Exame de preguntas obxectivas	Exame tipo test	50	CB2 CB3 CB5	CG1 CG2 CG4 CG5 CG7 CG8	CE19	CT3 CT4 CT5 CT11 CT13
Presentación	Presentación en clase do traballo en grupo desenvolvido.	5	CB2 CB3 CB4 CB5	CG1 CG2 CG4 CG5 CG7 CG8	CE19	CT2 CT3 CT4 CT5 CT6 CT8 CT9 CT10 CT11 CT12 CT13

Other comments on the Evaluation

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 materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, no exame final de avaliación continua, non inferior a 4.0.

-Entregar todas as 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 4.0.

(2) Estudante que, tras unha autorización por parte do profesorado, desexen ser avaliados mediante avaliación única:

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua.

Os estudantes que teñan unha xustificación poderán 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 alumno deberá superar o 5 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

A renuncia á avaliación continua debe facerse durante o primeiro mes de clase. Durante este período, presentarase o xustificante ao coordinador da materia para a súa avaliación.

Segunda oportunidade e Fin de Carreira

Os alumnos que non superasen a materia na primeira oportunidade poderán realizarán un exame que suporá o 100% da nota. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

En caso de detección de copia 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

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

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

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

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

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Empresa: Administración da tecnoloxía e a empresa/O07G410V01204

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID-19, a Universidade establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno, atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial.

Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dunha maneira mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado, e o profesorado, a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

Escenario de docencia mixta

Debido á situación excepcional, ante a imposibilidade de poder impartir a docencia dun modo totalmente presencial, utilizaranse medios virtuais tanto síncronos como asíncronos para a impartición das clases que sexan habilitadas pola Universidade de Vigo.
As prácticas serán entregadas polos estudantes e avaliadas empregando os recursos das plataforma de teledocencia dispoñible no seu momento.
As sesións de titorización, tanto o nivel individual como o nivel de grupos poderán realizarse por medios telemáticos (correo electrónico, videoconferencia, salgas/aulas/despachos virtuais proporcionadas pola Universidade de Vigo).

=== ADAPTACIÓN DAS METODOLOXÍAS ===
As metodoloxías docentes mantéñense principalmente cunha posible modificación temporal na planificación segundo a situación concreta.
Non procede ningunha modificacións dos contidos para impartir.
Auméntase a bibliografía co material de elaboración propia (por exemplo, guías de traballo, vídeos e textos explicativos, problemas resoltos, etc.) para facilitar a auto-aprendizaxe.

=== ADAPTACIÓN DA AVALIACIÓN ===
As probas mantéñense coas súas ponderacións previstas.

IDENTIFYING DATA				
Navigational systems				
Subject	Navigational systems			
Code	O07G410V01901			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	González Jorge, Higinio			
Lecturers	Arias Sánchez, Pedro González Jorge, Higinio			
E-mail	higiniog@uvigo.es			
Web	http://aero.uvigo.es			
General description	This course expose the main procedures and systems used in aircraft navigation. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

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

Contents

Topic	
1. Introduction to aircarft navigation.	1.1. Basic concepts of cartography and geodesy. 1.2. Aeronautical charts. 1.3. Aircarft navigation concept. Observed, estimated, radioelectric and autonomous navigation. 1.4. Terminology (heading, azimuth, magnetic declination, nautical mile, knot, foot, etc.). 1.5. The wind in the air navigation. Wind triangle. 1.6. Orthodromic route. Characteristics, parameters and equations. 1.7. Loxodromic route. Characteristics, parameters and equations. 1.8. The altimetry in air navigation. Standard atmosphere. Pressure, density and temperature. The barometric altimeter.
2. Meteorology and aircarft navigation.	2.1. VMC and IMC weather conditions. Visual and instrumental navigation. VFR and IFR flight rules. 2.2. Basic flight instruments. 2.3. Technical requirements for visual and instrumental flight. 2.4. Organization of the aeronautical meteorological service in Spain through AEMET.
3. Conventional navigation systems.	3.1. Directional radio signals. 3.2. Route beacons. 3.3. Automatic direction finder (ADF). 3.4. Non-directional beacon (NDB). 3.5. High frequency omnidirectional radio beacon (VOR). 3.6. Long Range Navigation systems (LORAN and NavSat).
4. RNAV navigation.	4.1. Three-dimensional navigation system. Course line computer. 4.2. Inertial navigation system (INS). 4.3. Doppler radar.
5. Distance measuring equipment (DME).	5.1. Frequencies 5.2. DME theory. 5.3. Specifications and errors.
6. Instrument landing system (ILS).	6.1. Guide and locator information. Ground and on board systems. 6.2. Glide path. Ground and on board systems. 6.3. Distance information. Radio beacon. Ground and on board systems. 6.4. Compass radio beacons. 6.5. Visual information. VASIS system. 6.6 Category of the ILS.
7. Microwave landing system (MLS).	7.1. MLS principles. 7.2. Ground system. 7.3. On board system.
8. RADAR.	8.1. Introduction. 8.2. Primary RADAR. 8.3. Secondary RADAR. 8.4. Meteorological RADAR.
9. Global Navigation Satellite System (GNSS).	9.1. Principles of satellite navigation. 9.2. GNSS segments. 9.3. GNSS signals. 9.4. Operation of the GNSS system. 9.5. GPS, GLONASS, GALILEO and BEIDOU systems. 9.6. The future of the GNSS system.
10. Air traffic control systems (ATC).	10.1. Review of ATC systems. 10.2. Transponders 10.3. On board systems. 10.4. System operation 10.5. ADSB system. 10.6. Communications, navigation and surveillance in ATC.
11. Traffic alert and collision avoidance system (TCAS).	11.1. TCAS system. 11.2. TCAS operation.
12. Aircarft navigation and unmanned aerial vehicles.	12.1. Airspace. 12.2. Rules for unmanned aerial vehicles. 12.3. On board navigation systems in unmanned aerial vehicles. 12.4. Future trens in unmanned aerial vehicles.
13. Aircraft navigation and safety.	13.1. Governmental aeronautical safety agency (AESA). 13.2. Aircraft navigation services in Spain (ENAIRE). Air traffic management. Aeronautical information service (AIS).

Planning			
	Class hours	Hours outside the classroom	Total hours

Lecturing	24	0	24
Practices through ICT	24	25	49
Mentored work	2	75	77

*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. On-line tutorials. Attention by email.
Practices through ICT	Classroom attention. On-line tutorials. Attention by email.
Mentored work	On-line tutorials. Attention by email.

Assessment

	Description	Qualification	Evaluated Competencess			
Lecturing	There will be two partial exams to test the theoretical content of the subject. Each one will have a weight of 25% in the global mark of the subject. Each exam will consist of a total of 30 questions.	50	CB2 CB3 CB5	CG1 CG6	CE19	CT3 CT4 CT6 CT8 CT11
Practices through ICT	Each practice will define a deliverable that the student must send to the professor before the indicated deadline.	30	CB2 CB3 CB5	CG1 CG6	CE19	CT3 CT4 CT6 CT8 CT11
Mentored work	The student must deliver a final report with the work done. In addition, the student must perform a presentation.	20	CB2 CB3 CB5	CG1 CG6	CE19	CT3 CT4 CT6 CT8 CT11

Other comments on the Evaluation

The continuous evaluation tests will be carried out during university class hours.

The official exam dates are used for the student to take a comprehensive examination of the course if he/she does not follow the continuous evaluation 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 2.5 hours.

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

Contingency plan

Description

In prevention of a health alert caused by COVID-19, the following is established:

Theoretical, practical teaching and tutoring for students are planned to migrate if necessary to 100% virtual teaching, without the need for a physical presence in the classroom.

The evaluation tests will be carried out virtually using the MOOVI and Remote Campus tools.

IDENTIFYING DATA				
Materials for the aerospace industry				
Subject	Materials for the aerospace industry			
Code	O07G410V01903			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Álvarez González, David Guitián Saco, María Beatriz			
Lecturers	Álvarez González, David Guitián Saco, María Beatriz			
E-mail	davidag@uvigo.es bea.guitian@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.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes				
Learning outcomes	Competences			
New	CB2 CB3 CB5	CG1	CE20	CT3 CT4 CT5 CT6 CT8 CT11 CT13
New	CB2 CB3 CB5	CG1	CE20	CT3 CT4 CT5 CT6 CT8 CT11 CT13

New	CB2 CB3 CB5	CG1	CE20	CT3 CT4 CT5 CT6 CT8 CT11 CT13

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 prperties.
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	Evaluated Competencess			
Laboratory practical	Reports of the lab work that the student will have to deliver (individual or in groups).	10	CB2 CB3 CB5	CG1	CE20	CT4 CT5 CT6 CT8 CT11 CT13
Practices through ICT	Reports of the lab work that the student will have to deliver (individual or in groups).	10				
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.	60	CB2 CB3 CB5	CG1	CE20	CT3 CT4 CT5 CT8 CT11 CT13
Presentation	Oral presentation by groups of a subject proposed during the development of the matter.	20	CB2 CB3 CB5	CG1	CE20	CT3 CT4 CT5 CT6 CT8 CT11

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 this 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 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

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide *antelación) by the students and the *profesorado through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

* Educational Methodologies that modify :

The no face-to-face teaching will take place by means of synchronous and asynchronous activities reinforcing so much the employment of the platform *Moovi like the use of the virtual classrooms of the University of Vigo, so that the student/to can reach without problem the total of the competitions prefixed with the lower possible change with regard to the face-to-face teaching.

* Mechanism of remote attention to the students (individual mentorship):

The individual mentorship will be made through the available telematic means in the University of Vigo employing of preferential way the virtual dispatch of the professor of the matter.

* Modifications (if they proceed) of the contents to give:

No modifications in the general contents of the matter.

* Additional bibliography to facilitate the car-learning:

In addition to the sources of information collected in the educational guide will include material of additional query like extracts of chapters of books as well as distinct links of audiovisual content related with each subject and in function of the evolution of the contents of the matter.

=== ADAPTATION OF THE EVALUATION ===

Because of the impossibility to make face-to-face proofs during the course, makes a modification of the system of evaluation of the educational guide with the aim to be able to make 100% of the evaluation of the matter by means of proofs of character no face-to-face. These will make by means of the distinct telematic means available
along the course.

System of evaluation modified:

Practices of laboratory, reports of realisation of practices that the student/to will have to deliver of individual way or by groups with 20% of the final note.

Examination of objective questions, proof written in which the student/to will have to answer to relative questions to the matter with 40% of the final note.

Questionnaires or resolution of problems of individual way with 20% in the final note.

Individual oral presentation or by groups of a subject proposed during the development of the matter with 20% in the final note.

The student that renounce to the continuous evaluation by means of the distinct proofs of evaluation, will have right to the realisation of a final proof where will be able to obtain 100% of the qualification of the matter.

* Additional information

The corresponding data to schedules, classrooms and dates of examinations will be able to consult of up to date form in the web page of the centre: http://aero.uvigo.es/gl/docencia/examenes

IDENTIFYING DATA				
Systems in real time				
Subject	Systems in real time			
Code	O07G410V01904			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	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.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

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

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	29	60	89
Laboratory practical	13	16	29
Mentored work	6.5	23	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	Evaluated Competencess		
Laboratory practical	Reports on practical classes, as required	20	CB2 CB3 CB5	CE24 CE31	CT11
Mentored work	Presentation and report on the mentored work	40	CB2 CB3 CB5	CE24 CE31	CT11
Objective questions exam	Examen	40	CB2 CB3 CB5	CE24 CE31	CT11

Other comments on the Evaluation

The calendar of evaluation tests officially approved by the Xunta de Centro of the EEAE is published on the website of the School (normally, at http://aero.uvigo.es/gl/docencia/exames)

First oportunity:

- 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 oportunity:

- Students who have not passed the subject in the first oportunity will take an extraordinary exam 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.

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

Air transport and airborne systems/O07G410V01404

Contingency plan

Description

The evaluation will be carried out, under normal conditions, under the indications reflected in this guide.

In the event of exceptional circumstances that impede the normal development of teaching, an online teaching will be chosen (whenever possible) via streaming (live), through the tools provided by the University of Vigo. The evaluation tests would be carried out, in this case, remotely with the tools of the University; the evaluation criteria will be maintained in non-classroom teaching, except for extraordinary reasons that totally prevent said option.

In the event that teaching is carried out in a mixed way, the evaluation criteria will be maintained as well, except for extraordinary reasons that make this option totally impossible. The evaluation tests would be carried out, in this case, remotely with the tools of the University.

In both cases, tutoring meetings will take place remotely via the tools provided by the University, in a moment subject to agreement between the teacher and the student.

IDENTIFYING DATA				
Meteorology				
Subject	Meteorology			
Code	O07G410V01905			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	de la Torre Ramos, Laura			
Lecturers	de la Torre Ramos, Laura Ferriz Mas, Antonio Vázquez Domínguez, Marta			
E-mail	ltr@uvigo.es			
Web	http://aero.uvigo.es			
General description	Introduction to meteorology, the measurement of parameters, the instrumentation and its influence on the flight. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE10	Understand how the aerodynamic forces determine the dynamics of the flight and the role of the different variables therein.
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

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

Contents	
Topic	
Atmosphere and meteorology	The atmosphere Composition and structure Meteors
Instrumentation and meteorological information	Meteorological observations in airfields Meteorological observations from aircraft The meteorological radar Satellites Aeronautical meteorological Information
Thermodynamics	Sounding data Isobaric and adiabatic condensation Aerological diagrams Temperature and humidity parameters and stability levels Stability assessment Effects on the flight

Wind	Introduction Equation of movement Horizontal flow Isobaric coordinates Thermal wind Wind structure in the PBL Effects on the flight
Clouds microphysics	Aerosols Previous concepts Warm clouds Cold clouds Effects on the flight
Convection	Previous concepts Convective storms Dynamics of supercells Electricity Downburst Mesoscale convective systems (MCS) Effects on the flight
Visibility	Introduction Factors affecting visibility Fogs and strata Duststorms Effects on the flight
Depressions	Introduction Tropical cyclones Extratropical cyclones Thermal lows Effects on the flight
Meteorological prediction	Prediction Numerical weather prediction
Meteorology and space operations	Fundamental characteristics Launching conditions Reentry conditions Influence in orbit

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	15	40
Autonomous problem solving	15	20	35
Practices through ICT	10	0	10
Presentation	1	5	6
Objective questions exam	2	30	32
Essay	0	27	27

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

Methodologies

	Description
Lecturing	Theoretical classes in the classroom for all the group. The students will have to complete assignments that will help to fix or expand their knowledge.
Autonomous problem solving	Student will be asked to perform tasks or exercises autonomously. Part of these exercises will have to be completed out of the classroom. The professor will supervise the tasks
Practices through ICT	Seminars using computers. Personalized follow-up of the student during the class. Students will be asked to solve different exercises.
Presentation	(*)Presentación dun traballo en clases co obxectivo de demostrar o aprendido durante a realización do traballo e de ensinar ós compañeiros

Personalized assistance

Methodologies	Description
Lecturing	Assistance during class and tutorials
Practices through ICT	Assistance during class and tutorials
Autonomous problem solving	Assistance during class and tutorials

Presentation	
Tests	**Description**
Essay	

Assessment

	Description	Qualification	Evaluated Competencess		
Autonomous problem solving	Evaluation of the student's involvement in classes. Evaluation of the student's performance in the proposed tasks or problem resolution.	20	CB2 CB3 CB5	CE10	CT11
Practices through ICT	Evaluation of the student's involvement in classes	5	CB2 CB3 CB5	CE10	CT11
Presentation	(*)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.	10	CB2		CT11
Objective questions exam	Answering of short answers questions plus resolution of two or three problems	55	CB2 CB3 CB5	CE10	CT11
Essay	(*)O alumnado terá que facer un traballo orientado a como a meteoroloxía pode afectar ás operacións aéreas ou espaciais.	10	CB2 CB3 CB5		CT11

Other comments on the Evaluation

Continuous assessment:

To pass the subject through continuous assessment, it will be compulsory to attend at least 21 hours out of the 25 face-to-face sessions corresponding to the practices in computer rooms (seminars) and deliver all the tasks proposed to be done outside the classroom (both for the theoretical and the practical part).

It will also be mandatory: i) to take the written test, ii) to make the presentation

In addition, the student will have to achieve at least half of the total grade in each of the assignments that are graded.

In the event that a student cannot apply to continuous evaluation (for justified reasons):

The oral presentation and the delivery of the exercises proposed in seminars are compulsory, in addition to taking the written test. In addition, the student will have to achieve at least half of the total grade in each of one.

In this case the qualification percentages will be:

20% exercises proposed in seminars

10% Presentation

70% Written test

Second opportunity:

100% exam.

In case of not attending the test, or not passing it, the student will be evaluated in the same way as the rest of the students for the following calls.

End of degree call

The student who chooses to take the exam at the end of the degree will be evaluated only with the exam (which will be worth 100% of the grade). In case of not attending this exam, or not passing it, it will be evaluated in the same way as the rest of the students for the following calls.

Exam dates:

The exam dates are published on the website http://aero.uvigo.es/gl/docencia/exames

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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

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

Recommendations

Contingency plan

Description

1. MIXED MODALITY: part of the classes will be face-to-face and, if the number of students makes it necessary, another part will be through the Remote Campus
1.1. ADAPTATION OF THE METHODOLOGIES:
1.1.1.MASTER SESSION: part of the classes will be face-to-face and, if the number of students makes it necessary, another part will be through the Remote Campus
1.1.2.SEMINARS: part of the classes will be face-to-face and, if the number of students makes it necessary, another part will be through the Remote Campus
1.2. EVALUATION:
1.2.1.END OF CAREER: the test will represent 100% of the grade.
1.2.2.FIRST OPPORTUNITY: the percentage of involvement in face-to-face classes will be changed for involvement in face-to-face or virtual classes.
1.2.3.SECOND OPPORTUNITY: the test will represent 100% of the grade.
1.3. TUTORIALS: The tutoríals will be in the professor's virtual office, by appointment

2. DISTANCE MODALITY: all the classes will be through the Remote Campus
2.1. ADAPTATION OF THE METHODOLOGIES:
2.1.1.MASTER SESSION: all the classes will be through the Remote Campus
2.1.2.SEMINARS: all the classes will be through the Remote Campus
2.2. EVALUATION:
2.2.1.END OF CAREER: the examination will suppose 100% of the note.
2.2.2.FIRST OPPORTUNITY: the percentage of involvement in face-to-face classes will be changed for involvement in virtual classes. The "Autonomous problem solving" will represent 10% of the grade whereas the "Objective questions exam " will represent 65% of the grade
2.2.3.SECOND OPPORTUNITY: the examination will represent 100% of the grade.
2.3. TUTORIALS: TUTORIALS: The tutoríals will be in the professor's virtual office, by appointment

IDENTIFYING DATA				
Information management systems				
Subject	Information management systems			
Code	O07G410V01910			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Celard Pérez, Pedro			
Lecturers				
E-mail				
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.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Learning outcomes	Competences		
RA1: Understanding, application and analysis of information management systems in aerospace projects.	CB2 CB3 CB5	CE24	CT11

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	20	30	50
Problem solving	11	25	36
Introductory activities	1	1.5	2.5
Essay questions exam	2.5	5	7.5

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

Methodologies

	Description
Lecturing	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	Evaluated Competencess		
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	CB2 CB3 CB5	CE24	CT11
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	CB2 CB3 CB5	CE24	CT11
Essay questions exam	Partial tests that include open questions about the content of the subject. Students must develop, relate, organize and present the knowledge they have on the subject in a reasoned answer. Learning outcomes assessed: RA1	60	CB2 CB3 CB5	CE24	CT11

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 final 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 2021-22 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 edition of the minutes:

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 edition of the minutes:

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.

Evaluation criteria for 2nd edition of minutes 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**, 4, Pearson Educación, 2005

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

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Computer science/O07G410V01104

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===

Faced with the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it according to criteria of safety, health and responsibility , and guaranteeing teaching in a non-face-to-face or partially face-to-face setting. These measures already planned guarantee, when it is mandatory, the development of teaching in a more agile and efficient way, since it is known in advance (or well in advance) by the students and teachers through the standardized tool and institutionalized teaching guides.

=== ADAPTATION OF METHODOLOGIES ===

* Teaching methodologies that are maintained
- All

* Teaching methodologies that are modified
- The tutorials will become online, using Remote Campus.
- Face-to-face classes will be taught through Campus Remoto and Moovi, without prejudice to other environments and mechanisms that can be used to guarantee maximum access for students to the contents and materials of the subject.

* Non-face-to-face mechanism of attention to students (tutorials). The tutorials of students of any modality will be attended through the following mechanisms:
- Remote Campus
- Forums of the subject in Moodle
- Email
In all cases, a prior agreement mechanism may be set up to order access to tutorials.

* Modifications (if applicable) of the content to be taught
- None

* Additional bibliography to facilitate self-study
- It is not contemplated

* Other modifications
- They are not contemplated

=== ADAPTATION OF THE EVALUATION ===

* Tests already carried out
- The weight is maintained in the final qualification

* Pending tests that remain
- The weight is maintained in the final qualification

* Tests that are modified
- Development question exams => would be done online, using Campus Rmoto and Moovi.

* New tests
- They are not contemplated.

* Additional Information
- It is not contemplated.

IDENTIFYING DATA

Tecnoloxías para conformado de materiais aeroespaciais

Subject	Tecnoloxías para conformado de materiais aeroespaciais			
Code	O07G410V01913			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
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.			

Competencias

Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CE12	Comprender os procesos de fabricación.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CE30	Coñecemento adecuado e aplicado á Enxeñaría de: As prestacións tecnolóxicas, as técnicas de optimización dos materiais utilizados no sector aeroespacial e os procesos de tratamentos para modificar as súas propiedades mecánicas.
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados de aprendizaxe

Learning outcomes	Competences		
O/a estudante coñece os procesos de produción, os seus principais parámetros definitorios e o seu campo de aplicación.	CB2 CB3 CB5	CE12 CE19 CE30	CT11
O/a estudante coñece toda a información necesaria para levar a cabo un proceso de produción.	CB2 CB3 CB5	CE12 CE19 CE30	CT11
O/a estudante é capaz de realizar un informe que permita a execución exitosa dun proceso de produción.	CB2 CB3 CB5	CE12 CE19 CE30	CT11
Coñecer adecuadamente e de forma aplicada á enxeñaría as prestacións tecnolóxicas, as técnicas de optimización dos procesos de fabricación con materiais utilizados no sector aeroespacial para modificar as súas propiedades funcionais mecánicas.	CB2 CB3 CB5	CE12 CE19 CE30	CT11

Contidos

Topic

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 industrial
Bloque II	Proxectos

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	16	25	41
Prácticas con apoio das TIC	9.5	15	24.5
Aprendizaxe colaborativa	18	12	30
Aprendizaxe baseado en proxectos	1.5	37.5	39
Prácticas de laboratorio	5	8	13
Resolución de problemas e/ou exercicios	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, 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.

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.

Avaliación

	Description	Qualification	Evaluated Competencess		
Lección maxistral	Evaluación de conceptos mediante cuestionario breve	20	CB5	CE12 CE19 CE30	
Prácticas con apoio das TIC	Entrega de memorias de prácticas	20	CB2 CB3 CB5	CE12 CE19 CE30	CT11
Aprendizaxe colaborativa	Realización dos traballos propostos e entrega de informes, pezas.	20	CB2 CB3 CB5	CE12	
Aprendizaxe baseado en proxectos	Entrega memoria de proxecto	40	CB2 CB3 CB5	CE12 CE19 CE30	CT11

Other comments on the Evaluation

PRIMEIRA OPORTUNIDADE:

A materia avalíase en modo de evaluación continua en base a:

-Memoria do proxecto (nota máxima 4 puntos).

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

-Aprendizaxe colaborativo (nota máxima 2 puntos). Deberase 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.

Poderanse gardar traballos da primeira oportunidade con cualificación >5. A nota do exame non se gardará.

OUTRAS CONSIDERACIÓNS:

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

Fabricación aeroespacial/O07G410V01501

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo *COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen
Todas se manteñen en formato asíncrono ou síncrono a distancia. Para iso empregaranse os medios dispostos pola Universidade de Vigo: Campus Remoto e/ou MOOVI.

* Mecanismo non presencial de atención ao estudantado (titorías)

Desenvolveranse mediante email ou videoconferencia en despacho virtual.

=== ADAPTACIÓN DA AVALIACIÓN ===

* Información adicional
A avaliación mantense sen cambios en calquera circunstancia.
No escenario multimodal e/ou non presencial, cando cumpra, o persoal docente implicado na impartición da docencia resérvase o dereito de non dar o consentimento para a captación, publicación, retransmisión ou reprodución do seu discurso, imaxe, voz e explicacións de cátedra, no exercicio das súas funcións docentes, no ámbito da Universidade de Vigo.

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

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

Resultados de aprendizaxe			
Learning outcomes	Competences		
Compresión das ecuacións e principios xerais do medio continuo, así como a axeitada selección dos diferentes modelos de compartamento de sólidos deformables	CB2	CE26 CE33	CT4 CT5 CT11
Análise de sólidos e estruturas sometidas a tensións superiores ao límite elástico e a cargas cíclicas	CB3 CB4	CE20	CT4 CT6 CT8 CT11
Coñecemento, comprensión, aplicación, análise e síntese da teoría de estruturas	CB3 CB4	CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11
Coñecemento dos aspectos máis destacados do comportamento estrutural de aeronaves	CB2 CB3	CE20 CE26 CE33	CT4 CT5 CT8

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

Planificación	Class hours	Hours outside the classroom	Total hours
Lección maxistral	40	17	57
Resolución de problemas	10	0	10
Prácticas de laboratorio	25	10	35
Resolución de problemas de forma autónoma	0	120	120
Exame de preguntas de desenvolvemento	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 na aula dos coñecementos básicos da materia.
Resolución de problemas	Resolución de problemas relacionados cos contidos teóricos.
Prácticas de laboratorio	Realización de prácticas no laboratorio e/ou realización de prácticas en aula informática e/ou resolución de problemas prácticos
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios de forma autónoma por parte do alumno

Atención personalizada	
Methodologies	**Description**

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

Avaliación

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

Other comments on the Evaluation

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

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

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen

Lección maxistral: Exposición da teoría básica da materia.
Prácticas: Resolución de problemas relacionados cos contidos teóricos.
Ambas metodoloxías serán adaptadas a un contexto de docencia non presencial a tráves do uso de ferramentas de teledocencia dispoñibles na Universidade de Vigo (Moovi, Campus Remoto ou outros).
Primarase a impartición dos contidos teóricos por medios telemáticos así como aqueles contidos de prácticas de resolución de problemas, aula de informática, e outros, que poidan ser virtualizados ou desenvolvidos polo alumnado de xeito guiado.

* Mecanismo non presencial de atención ao alumnado (titorías)

As titorías serán atendidas no espacio temporal habitual a través de medios telemáticos ordinarios (correo electrónico, Moovi) así como dos despachos virtuais do profesorado dispoñibles no Campus Remoto da Universidade de Vigo.

=== ADAPTACIÓN DA AVALIACIÓN ===

* Probas pendentes que se manteñen
Exame de preguntas de desenvolvemento: [Peso anterior 90%] [Peso Proposto 90%]

* Probas que se modifican
[Prácticas de laboratorio: Asistencia e participación activa nas clases prácticas. (5%) Resolución de problemas e/ou exercicios de forma autónoma. (5%)]
=>
[Resolución de problemas e/ou exercicios de forma autónoma.
(10%)]

As probas de avaliación desenvolveranse de forma presencial salvo Resolución Reitoral que indique que se deben facer de forma non presencial, realizándose dese xeito a través das distintas ferramentas postas a disposición do profesorado.
Aquelas probas non realizables de forma telemática se suplirán por outras (entregas de traballo autónomo guiado, etc.)

IDENTIFYING DATA				
Mecánica de fluídos II e CFD				
Subject	Mecánica de fluídos II e CFD			
Code	O07G410V01922			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Martín Ortega, Elena Beatriz Rodríguez Pérez, Luis			
Lecturers	Martín Ortega, Elena Beatriz Rodríguez Pérez, Luis			
E-mail	emortega@uvigo.es lurodriguez@uvigo.es			
Web	http://aero.uvigo.es			
General description	Coñecemento, compresión e aplicación de conceptos e técnicas da Mecánica de Fluídos de Enxeñaría Aeroespacial Parte do curso presentase como unha introdución a dinámica de fluidos computacional que, partindo de un conocimiento de las ecuaciones de conservación de los fluidos (xa adquiridos por estudantes en materias anteriores) permita al alumno realizar simulacións sinxelas que involucren un fluído como medio de traballo.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CE16	Coñecemento adecuado e aplicado á Enxeñaría de: Os conceptos e as leis que gobernan os procesos de transferencia de enerxía, o movemento dos fluídos, os mecanismos de transmisión de calor e o cambio de materia e o seu papel na análise dos principais sistemas de propulsión aeroespaciais.
CE18	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos; os principios básicos do control e a automatización do voo; as principais características e propiedades físicas e mecánicas dos materiais.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.
CE22	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en todos os réximes, para determinar as distribucións de presións e as forzas sobre as aeronaves.
CE25	Coñecemento adecuado e aplicado á Enxeñaría de: os métodos de cálculo de deseño e proxecto aeronáutico; o uso da experimentación aerodinámica e dos parámetros máis significativos na aplicación teórica; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación, deseño, análise e interpretación de experimentación e operacións en voo; os sistemas de mantemento e certificación de aeronaves.
CE26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.
CE28	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en calquera réxime e determinan as distribucións de presións e as forzas aerodinámicas.
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados de aprendizaxe	
Learning outcomes	Competences

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

Contidos	
Topic	
CFD. Ecuacións xerais e fenómenos de transporte	Tema 1: Resumo das ecuacións xerais. Notación integral Notación diferencial Forma conservativa. Notación compacta Modelos límite máis comúns Condicións de contorno máis comúns
CFD. Turbulencia	Tema 2: Introdución á turbulencia Introdución Escala de Kolmogorov Inviabilidad da simulación numérica directa Modelos de turbulencia: Modelos RANS: -Medias de Reynolds e de Favre -Ecuacións promediadas. Esforzos aparentes de Reynolds. Problema do peche - Hipótese de Boussinesq: modelos algebraicos, dunha ecuación e de dúas ecuacións - Leis de parede. Modelos de alto e baixo número de Reynolds - Modelos de transporte de esforzos aparentes de Reynolds Modelos LLES: Descrición

CFD. Introdución á dinámica de Fluídos Computacional	Tema 3: Métodos FVM de resolución numérica das ecuacións de Navier-Stokes. Métodos de Volumes Finitos (FVM): - Introdución - Discretización do dominio computacional - Discretización das ecuacións de fluídos - Ecuacións discretizadas en FVM - Discretización das condicións de contorno Fluxos incompresibles. Ecuación de presión - Métodos de compresibilidad artificial - Axustes presión-velocidade - Métodos de aceleración da resolución numérica máis comúns Tema 4: Introdución ao uso de distintos software (OpenFoam e Fluent) de simulación numérica de fluídos. Prácticas en aula informática. *O uso deste software quedará condicionado á dispoñibilidade de licenzas de uso por parte do centro así como á correcta instalación dos mesmos na aula informática asignada Aplicacións: - Fluxo laminar no interior dunha cavidade - Fluxo nun dispositivo mesturador de correntes - Forzas aerodinámicas sobre corpos: Fluxo ao redor dun obstáculo. Fluxo laminar e fluxo turbulento Cálculo da rúa de Kármán tras un corpo romo Fluxo incompresible sobre perfil aerodinámico Fluxo transónico sobre perfil aerodinámico -Exercicios/Proxectos propostos de simulación numérica para ser resoltos de forma máis independente polos alumnos.
Mecánica de Fluídos II. Fluxo de fluídos ideais. Movementos irrotacionais	Tema 1: Movementos irrotacionais. Condicións de irrotacionalidad Ecuacións do movemento irrotacional Condicións iniciais e de contorno Movemento irrotacional de líquidos Principio de superposición Potencial de velocidades a grandes distancias dun obstáculo Movemento plano irrotacional de líquidos: Solucións elementais. Corrente en recunchos e esquinas. Corrente ao redor dun cilindro con circulación Movemento irrotacional bidimensional de gases Expansión de Prandtl-Meyer Tema 2: Movementos con superficies de discontinuidad Ecuacións do salto das magnitudes fluídas nunha discontinuidad Discontinuidades normais e tangenciales Ondas de choque normais Ondas de choque oblicuas Aplicación: Movemento case unidimensional de fluídos ideais: Área crítica. Movemento en toberas. Carga e descarga en depósitos. Ondas de choque. Relación de Hugoniot.
Mecánica de Fluídos II. Movementos unidimensionales non estacionarios de fluídos ideais	Tema 3: Movemento unidimensional non estacionario de fluídos ideais. Efecto de compresibilidad na líquidos Apertura e peche de válvulas. Golpe de ariete Ecuacións do movemento unidireccional non estacionario en gases. Ondas simples

Mecánica de Fluídos II. Movemento a baixos números de Reynolds	Tema 4: Movemento a baixos números de Reynolds Ecuacións. Condicións iniciais e de contorno Aplicación a fluídos incompresibles. Movementos ao redor dun cilindro e unha esfera Lubricación: Ecuación de Reynolds da lubricación 3D. Aplicacións. cojinete cilíndrico, lubricación con gases, patín rectangular, ...
Mecánica de Fluídos II. Capa límite	Tema 5: Capa límite laminar Capa límite laminar incompresible. Solucións de semellanza. Capa límite sobre placa plana. Solución de Blausius Capa límite laminar compresible Capa límite térmica a baixas velocidades
Mecánica de Fluídos II. Prácticas de laboratorio	- Ensaio en banco de aerodinámica: Medición capa límite - Ensaio en túnel de vento de baixa velocidade Distribución de presións sobre corpo romo - Distribución de presións en toberas converxentes e converxentes-diverxentes. Magnitudes críticas. Ondas de choque. Bloqueo sónico.

Planificación

	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	4	5	9
Lección maxistral	33	35	68
Aprendizaxe baseado en proxectos	8	19.5	27.5
Prácticas con apoio das TIC	8	0	8
Resolución de problemas	22	73	95
Proxecto	0	15	15
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
Prácticas de laboratorio	Realización das prácticas de laboratorio
Lección maxistral	Exposición da teoría Translación de problemas de fluídos a modelos matemáticos para ser resoltos numericamente
Aprendizaxe baseado en proxectos	Formulación e resolución numérica de problemas propostos aplicados a fluxos de fluídos
Prácticas con apoio das TIC	Formulación e resolución de modelos aplicados a fluxos de fluídos
Resolución de problemas	Resolución de problemas e/ou exercicios de forma autónoma por parte do alumno para comprender e caracterizar os distintos tipos de movementos de fluídos e os seus simplificaciones

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess

Aprendizaxe baseado en proxectos	Realización e entrega de informe das simulacións propostas ao alumno	20	CB2 CB3 CB5	CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28	CT3 CT4 CT5 CT6 CT8 CT11
Prácticas con apoio das TIC	Asistencia e participación activa nas prácticas	1.5	CB2 CB3 CB5	CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28	CT3 CT4 CT5 CT6 CT8 CT11
Resolución de problemas	Asistencia ás sesións de resolución de problemas e entrega dos problemas propostos	3.5	CB2 CB3 CB5	CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28	CT3 CT4 CT5 CT6 CT8 CT11
Exame de preguntas de desenvolvemento	Realización de probas escritas, incluíndo o exame final da materia	75		CE16 CE18 CE19 CE20 CE22 CE25 CE26 CE28	CT3 CT5

Other comments on the Evaluation

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

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

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

Segunda edición da acta:

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

Bibliografía. Fontes de información

Basic Bibliography

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

Panton, R. L., **Incompressible Flow**, 4th Edition, Wiley, 2013
Anderson, **Modern Compressible Flow**, 3nd Ed., Mc Graw Hill, 1992
BARRERO & PÉREZ-SABORID, **Fundamentos y aplicaciones de la Mecánica de Fluidos**, Mc Graw Hill, 2005
BLAZEK, J., **Computacional Fluid Dynamics: Principles and Applications**, Elsevier, 2001
H K Versteeg and W Malalasekera, **An Introduction to Computational Fluid Dynamics THE FINITE VOLUME METHOD**, 2nd Ed., Prentice Hall, 2007

Complementary Bibliography

Kundu , C., **Fluid Mechanics**, 4th Edition,, Academic Press, 2010
SCHLICHTING, H, **Boundary Layer Theory**, Mc Graw Hill, 1987
FERZIGER, J., MILOVAN, P., **Computational Methods for fluid Dynamics,**, Springer, 1999
F. Moukalled L. Mangani M. Darwish, **The Finite Volume Method in Computational Fluid Dynamics An Advanced Introduction with OpenFOAM® and Matlab®**, Springer, 2016
WILCOX, **Turbulence Modeling**, DCW Industries, 2004
www.openfoam.com,

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Métodos matemáticos/O07G410V01301
Mecánica de fluídos/O07G410V01402

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo *COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen: Todas excepto Prácticas en laboratorio docente de Mecánica de Fluídos, sempre que as circunstancias excepcionais obriguen a iso

* Metodoloxías docentes que se modifican: Prácticas en laboratorio. En caso de no ser posible realizalas presencialmente, sustituirasen pola resolución de problemas realcionados coas mesmas

* Mecanismo non presencial de atención ao alumnado (titorías): Mediante aula virtual en Campus remoto ou sistema similar prevía solicitude de cita por parte do alumno mediante email. Poderán ser individuais ou en grupos pequenos

* Modificacións (si proceden) dos contidos a impartir:Non procede

* Bibliografía adicional para facilitar o auto-aprendizaxe: Non procede

* Outras modificacións

...

* Probas que se modifican: As probas en si non se modificarán. Si o poderá facer a presencialidade das mesmas. De ser necesario pola situación de emerxencia realizaríanse telemáticamente usando preferentemente as ferramentas dispoñibles en Faitic.

* Novas probas

* Información adicional

IDENTIFYING DATA				
Aerodynamics and aeroelasticity				
Subject	Aerodynamics and aeroelasticity			
Code	O07G410V01923			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Navarro Medina, Fermín			
Lecturers	Navarro Medina, Fermín			
E-mail	fermin.navarro.medina@uvigo.es			
Web	http://aero.uvigo.es			
General description	The subject includes the aerodynamic forces that determine the dynamics of the flight and the role of the different variables involved in the aerodynamic phenomena of profiles, wings, and nozzles, considering both compressible and incompressible flow. An introduction to aeroelasticity is also made. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE20	Appropriate knowledge applied to engineering: mechanics of fracture of the continuous media and their dynamic behavior, fatigue of structural instability and aeroelasticity.
CE22	Appropriate knowledge applied to engineering: foundations of fluid mechanics that describe the flow in all regimes, to determine the distributions of pressures and forces on an aircraft.
CE25	Appropriate knowledge applied to engineering: methods of design calculations and aeronautical projects; use of aerodynamic experimentation and the most significant parameters in the theoretical application; management of experimental techniques, equipment and measuring instruments; simulation, design, analysis and interpretation of experimentation and operations in flight; systems of maintenance and certification of aircrafts.
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
CE28	Appropriate knowledge applied to engineering: foundations of fluid mechanics that describe the flow in any regime and determine the distribution of pressures and aerodynamic forces.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

Learning outcomes	Competences		
- Knowledge, understanding, application and analysis of the aerodynamic phenomena and of the laws that govern his behaviour;	CB2 CB3	CE22 CE26 CE28	CT3 CT4
- Knowledge, understanding and synthesis of the foundations of the flight of the aircraft	CB3 CB5	CE22 CE25 CE26	CT5 CT6
- Knowledge, understanding, application, analysis and synthesis of the methods applied to the study of aeroelasticity;	CB2 CB3	CE20 CE25 CE28	CT8 CT11
- 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)	CB3 CB5	CE20 CE25 CE28	CT3 CT4

- Knowledge, understanding, application, analysis and synthesis of aeroelasticity of one-dimensional and two-dimensional structures.;	CB3	CE20 CE22 CE26	CT6 CT8
- Knowledge and understanding of the most important appearances of experimental aeroelasticity, and more specifically of the essays in earth and in flight of aerostructures	CB5	CE20 CE25	CT8

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 transonic diet and supersonic Subject 2.2: linear Theory of compressible flow in profiles
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	0	15
Previous studies	0	126.5	126.5
Seminars	4	0	4
Problem solving	20	0	20
Workshops	6	0	6
Lecturing	30	0	30
Objective questions exam	3.5	0	3.5
Report of practices, practicum and external practices	0	20	20

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

Methodologies

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

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess

Seminars	The seminars consist in the realisation of exercises in groups of students and individually, that will have to resolve during the time of the seminar. So much the conjoint resolution of the exercise, like the individual contribution will be valued. They will make two asset seminars during the course.	5	CB2 CB3	CE20 CE22 CE26 CE28	CT3 CT4 CT5 CT6 CT8
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the subject	60	CB2 CB3 CB5	CE20 CE22 CE25 CE26 CE28	CT3 CT4 CT5
Report of practices, practicum and external practices	Report of the works made in the laboratory, and of the design of the profile and the wing.	35	CB2 CB3 CB5	CE20 CE22 CE25 CE26 CE28	CT3 CT4 CT6 CT11

Other comments on the Evaluation

Continuous assessment

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

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

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

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

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

Extraordinary exam

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

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

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

Sources of information

Basic Bibliography

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

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or long previously) by the students and the proffessor through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep
ALL except the practices of laboratory. The methodologies that keep will be adapted to the available technological resources (remote campus, virtual blackboard, etc). The guided work also can carry out on-line, without more than substituting the face-to-face meetings in group and the guided sessions with the professor by telematic meetings.

* Educational methodologies that modify
The practices of laboratory will be substituted by a bulletin of problems of character researcher

* Mechanism no face-to-face of attention to the students (tutoring sessions)
virtual office of the remote campus

* Modifications (if they proceed) of the contents to give
ANY

* additional Bibliography to facilitate the car-learning
Can use the same references

* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made
Tests Examination of objective questions: [previous Weight 60%] [Weight Proposed 60%]
Tests Seminar: [previous Weight 5%] [Weight Proposed 5%]
Tests Report of practices, *prácticum and external practices: [previous Weight 35%] [Weight Proposed 35%]

* pending Proofs that keep
Tests Examination of objective questions: [previous Weight 60%] [Weight Proposed 60%]
Tests Seminar: [previous Weight 5%] [Weight Proposed 5%]

* Proofs that modify
Proof Inform of practices, prácticum and external practices: [previous Weight 35%] [Weight Proposed 30%]. The tutoring work included in this proof is the one who evaluates .

* New proofs
Tests Resolution of problems and/or exercises: [previous Weight 0%] [Weight Proposed 5%]. The problems will deliver in shape of bulletin, with a date established in the moment of the delivery.

* Additional information
will inform of the links and the keys to access to the virtual classroom and to the virtual dispatch. The tutoring sessions will be in the virtual office, after previous agreement of the date and hour via mail.

IDENTIFYING DATA				
Mechanics of flight				
Subject	Mechanics of flight			
Code	O07G410V01924			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Navarro Medina, Fermín			
Lecturers	Navarro Medina, Fermín			
E-mail	fermin.navarro.medina@uvigo.es			
Web	http://aero.uvigo.es			
General description	Flight mechanics include the study of the performance, stability, and static and dynamic control of aerospace vehicles (focusing on fixed-wing aircraft in this course), as well as flight qualities and tests. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
CE23	Appropriate knowledge applied to engineering: physical phenomena of flight, its qualities and its control, aerodynamics, propulsive forces, active control and stability.
CE26	Applied knowledge of aerodynamics; mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed and rotary wings), theory of structures.
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

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

Contents	
Topic	
1. Introduction to the mechanics of flight.	1.1. Introduction to the mechanics of flight. 1.2. Systems of reference and angles in mechanics of flight. 1.3. General equations of the movement.

2. Performances of gliders and aeroplanes propulsados by air jets and by alternative engines.	2.1. Performances of gliders 2.2. Performances of aeroplanes propulsados by air jets in horizontal rectilinear flight 2.3. Performances of aeroplanes propulsados by air jets in another type of flights 2.4. Performances of aeroplanes propulsados by alternative engines 2.5. Performances in takeoff and landing
3. Stability and static and dynamic control	3.1. Stability and longitudinal static control 3.2. Stability and lateral static control-directional 3.3. Introduction to the stability and dynamic control
4. Introduction to the Qualities of Flight and to the Essays in Flight.	4.1. Introduction to the Qualities of Flight and to the Essays in Flight.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	18	0	18
Lecturing	28	0	28
Autonomous problem solving	0	80	80
Mentored work	4	17.5	21.5
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 that treat punctual appearances of the contents of the subject, developed by the professor and/or the students in the classroom.
Lecturing	Exhibition of a subject by part of the professor according to a previously established script
Autonomous problem solving	Study of the student of autonomous form, with the support of the professor if required according to the procedures established by the university
Mentored work	The tutoring work consists in the preparation of a project of design of an aircraft using the concepts learnt during the subject of mechanics of flight. It will be necessary on the other hand review key ideas of the subject of aerodynamics and aeroelasticidad. The work is of preparation in groups.

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess			
Mentored work	The tutoring work consists in the preparation of a project of design of an aircraft using the concepts learnt during the subject of mechanics of flight. It will be necessary on the other hand review key ideas of the subject of aerodynamics and aeroelasticity. The work is of preparation in groups.	25	CB2 CB3 CB5	CG6	CE23 CE26 CE31 CE33	CT4 CT5 CT6 CT8 CT11
Objective questions exam	Resolution of problems and/or conceptual questions on the contents of the subject	60	CB2 CB3 CB5	CG6	CE23 CE26 CE31 CE33	CT3 CT4 CT5 CT8 CT11

Other comments on the Evaluation

First edition of record (continuous Evaluation, first oportunity)

To surpass the subject in the evaluation in the 1ª opportunity will require obtain an upper qualification to 5 points over 10 in the global assessment of the continuous evaluation during the development of the classes and the examination in the official date. The qualification of the examination in official date has to be upper to 5 points on 10. The final qualification will obtain of agreement to the percentages indicated. The scored activities of the continuous evaluation will make during the lective

hours of the subject, by what requires the regular assistance to the classes by part of the students.

The calendar of proofs of evaluation approved officially by the Board of Centre gives EEAE publishes in the web

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

The maximum length of the examination will be of 3 hours if there is not interruption or of 5 hours if there is an intermediate pause (being 3 maximum hours for each part).

Second edition of record (Second oportunity)

The student will have to present to the examination of second opportunity of all the contents of the subject, that will suppose 100% of the grade, if the final note of continuous evaluation is lower that 5 points over 10. Also it will have to present to the examination of second announcement in the following supposed:

- The no realisation or delivery of any of the scored of the continuous evaluation inside the terms established for the same.

- Obtain an inferior grade to 5 points over 10 in the final examination of continuous evaluation.

In case to obtain a greater qualification or the same to 5 in the examination of second opportunity, the final qualification of the subject will be the greater note from among:

- the examination of second oportunity

- the average with the activities made during the course (promediando with the percentages of the table of evaluation)

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

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or long proviously) by the students and the proffesor through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep
ALL, adapted to the available technological resources (remote campus, virtual blackboard, etc). The tutoring work also can carry out on-line, without more than substituting the meetings and the tutoring sessions by the the face-to-face professor by telematic.

* Educational methodologies that modify
ANY

* no face-to-face Mechanism of attention to the students (tutoring sessions)
virtual office of the remote campus

* Modifications (if they proceed) of the contents to give
ANY

* additional Bibliography to facilitate the car-learning
Can use the same references

* Other modifications

=== ADAPTATION OF THE EVALUATION ===

In the case that the teaching have to give to distance from some moment of the period, distinguish two cases:

*** That all the assessed proofs already have been made in the moment of the change to teaching to distance:

- it Tests Examination of objective questions: 60%
- it Tests tutoring Work: 25%
- it Tests Resolution of problems and/or exercises: 15%

*** That there are pending proofs to make:
* Assessed Proofs remains to make in the moment of change to teaching to distance, that keep his percentages of evaluation:
- it Tests Examination of objective questions: [previous Weight 60%] [Weight Proposed 60%]
- Tests Work *tutelado: [previous Weight 25%] [Weight Proposed 25%]

* Assessed Proofs ramained to make in the moment of change to teaching to distance, that modify mildly:

- it Tests Resolution of problems and/or exercises: [previous Weight 15%] [Weight Proposed 15%]. In case of impossibility to make them in the classroom, the problems will deliver in shape of bulletin to deliver, with a date established in the moment of the delivery.

* New proofs
NO new exams

* additional Information
will inform of the links and the keys to access to the virtual classroom and to the virtual office. The tutoring sessions will make in the virtual office, after previous agreement of the date and hour via mail.

IDENTIFYING DATA				
Systems engineering and aerospace communications				
Subject	Systems engineering and aerospace communications			
Code	O07G410V01925			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Isasi de Vicente, Fernando Guillermo			
Lecturers	Isasi de Vicente, Fernando Guillermo			
E-mail	fisasi@uvigo.es			
Web	http:// aero.uvigo.es			
General description	Introduction to the engineering of systems and to the systems of communications with aerospace vehicles. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.
CT2	Leadership, initiative and entrepreneurship
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

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

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	30	75.5	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 grupal activity.
Laboratory practical	Use of simulators of systems of communications and/or navigation. Use of basic tools in the engineering of systems. With this methodology work the competitions CG1, CG4, CB3, CE19, CT2, CT4, CT5, CT6, CT11 and CT13. It is a grupal.activity.

Personalized assistance	
Methodologies	**Description**
Lecturing	Tutor sessions will be scheduled by the professor when a student sends an email asking for it. They will be at the professor's virtual office.
Laboratory practical	In the practices of laboratory the student can ask professor to resolve doubts. Tutor sessions will be scheduled by the professor when a student sends an email asking for it. They will be at the professor's virtual office.

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	Evaluation of group work and individual questions during the practical sessions. Cross asessment surveys can vary final marks as well. Also, cross assesment surveys may affect the marks. The continuous assessment tests will be carried out during the lectures' schedule.	20	CB5 CG1 CE19 CT4 CG4 CT5 CT6 CT8 CT13
Problem and/or exercise solving	Tests will have short practical questions and theoretical questions about the contents of magistral lectures. There are 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 a test or wants to improve mark, will make the test about all subject. In this case, the test will cover all subject. If the mark got in the first half part of test is not better than the one got in the middle of course test, the mark will be the one of middle course test. In case of online tuition, the tests would be online multiple choice tests or oral ones. In these cases the professor could ask student for a videoconference in which the student and near environment must be visible. The continuous assessment tests will be carried out during the lectrues' schedule.	80	CB3 CG1 CE19 CT4 CB5 CG4 CT5 CT8

Other comments on the Evaluation

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

Plan of contingency:

In case of online tuition, then the evaluation will be carried out as follows:

The tests would be by videoconference or by an online multiple choice test during a short time.

Also, oral tests may be done.

About the laboratory, the practices will be done by the student at home. The teams would work remotely and the laboratory lectures would be in remote mode. About the assesment, it would be similar as the normal case.

Sources of information

Basic Bibliography

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

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

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
Teaching methodologies maintained

Teaching methodologies modified

Non-attendance mechanisms for student attention (tutoring)

Modifications (if applicable) of the contents

Additional bibliography to facilitate self-learning

Other modifications

=== ADAPTATION OF THE TESTS ===
Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

Tests that are modified
[Previous test] => [New test]

New tests

Additional Information

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

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG7	Capacidade de analizar e valorar o impacto social e medioambiental das solucións técnicas.
CE21	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos de sustentabilidade, mantenibilidad e operatividade dos vehículos aeroespaciais.
CE23	Coñecemento adecuado e aplicado á Enxeñaría de: Os fenómenos físicos do voo, as súas cualidades e o seu control, as forzas aerodinámicas, e propulsivas, as actuacións, a estabilidade.
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe				
Learning outcomes	Competences			
- Coñecer as necesidades propulsivas das aeronaves	CB2 CB3 CB5		CE23	
- Coñecer os empuxes e resistencias relacionados cos aerorreactores	CB2 CB3 CB5	CG1	CE23	
- Coñecer e cuantificar de forma aplicada o proceso de combustión dos aerorreactores e o rendemento da combustión	CB2 CB3 CB5	CG1	CE21	CT13
- Saber realizar un balance enerxético diferenciando e calculando os rendementos involucrados	CB2 CB3 CB5			
- Saber resolver problemas relacionados co cálculo dos ciclos termodinámicos e as características dos aerorreactores; así como o efecto das características e calidade dos compoñentes	CB2 CB3 CB5			

- Coñecer os diferentes aerorreactores e saber obter os sistemas óptimos baixo o punto de vista propulsivo	CB2 CB3 CB5	CG7		
- Dimensionar os compoñentes que interveñen no sistema propulsivo	CB2 CB3 CB5	CG7		
- Coñecer o efecto das condicións de voo: velocidade e altitude no funcionamento dos aerorreactores	CB3 CB5	CG1	CE23	
- Coñecer os problemas ambientais dos aerorreactores e as súas posibles solucións	CB2 CB3 CB5	CG7	CE21	CT13
- Redactar informes técnicos e facer exposicións orais técnicas relacionadas co anterior	CB2 CB3			CT3 CT4 CT6 CT8 CT11
- Resolver problemas derivados do ámbito da materia de forma autónoma e en colaboración con outro	CB2 CB3			CT3 CT4 CT6 CT8
- 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	CB2 CB3 CB5		CE21 CE23	CT8
- Coñecemento dos aspectos máis destacados dos ensaios dos motores alternativos	CB2 CB3 CB5	CG7	CE21 CE23	
- Utilizar ferramentas informáticas de cálculo de actuacións de aerorreactores	CB2 CB3 CB5	CG1	CE23	CT4 CT8

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
Prácticas de laboratorio	20	0	20
Estudo previo	0	89.5	89.5
Lección maxistral	30	0	30
Exame de preguntas obxectivas	2.5	0	2.5
Informe de prácticas, prácticum e prácticas externas	0	8	8

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

Metodoloxía docente

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

Atención personalizada

Tests	Description
Exame de preguntas obxectivas	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	Evaluated Competencess			
Exame de preguntas obxectivas	Exame escrito de preguntas curtas e resolución de problemas	90	CB2 CB3 CB5	CG1 CG7	CE21 CE23	CT3 CT4 CT8 CT11 CT13
Informe de prácticas, prácticum e prácticas externas	Informe das prácticas de laboratorio (solución dos exercicios propostos nas sesións prácticas)	10	CB2 CB3 CB5	CG1 CG7	CE21 CE23	CT3 CT4 CT6 CT8 CT11 CT13

Other comments on the Evaluation

Primeira edición da acta (avaliación continua, primeira convocatoria)

Para superar a materia na avaliación na primeira convocatoria se requerirá obter unha calificación superior a 5 puntos sobre 10 na valoración conxunta da avaliación 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 partes das preguntas curtas, resolución de problemas e informe das prácticas). A calificación do exame en data oficial debe ser superior a 5 puntos sobre 10. A calificación final se obtendrá de acordo ás porcentaxes indicadas. As actividades puntuables da avaliación continua se realizará durante as horas lectivas da materia, polo que se require a asistencia regular ás clases por parte do alumnado.

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

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

Segunda edición da acta (segunda convocatoria)

O/a estudante deberá presentarse ao exame extraordinario de todos os contidos da materia, que supondrá o 100% da nota, si a nota final de avaliación continua é menor que 5 puntos sobre 10. Tamén tendrá que presentarse ao exame extraordinario nos seguintes supostos:

- A non realización ou entrega dalgún dos puntuables da avaliación continua dentro dos prazos establecidos para os mesmos.

- Obter unha nota inferior a 5 puntos sobre 10 no exame final de evaluación continua.

Bibliografía. Fontes de información

Basic Bibliography

F. PAYRI / J. M. DESANTES, **MOTORES DE COMBUSTIÓN INTERNA ALTERNATIVOS**, 978-8429148022, EDITORIAL REVERTE, 2011

MARTÍN CUESTA ÁLVAREZ, **MOTORES DE REACCIÓN**, 978-8428328258, 9ª EDICIÓN, EDICIONES PARANINFO, 2001

ANTONIO ESTEBAN OÑATE, **CONOCIMIENTOS DEL AVIÓN (LIBROS II Y III)**, 978-8428341769, 7ª EDICIÓN, EDICIONES PARANINFO, 2019

Complementary Bibliography

JACK D. MATTINGLY, **ELEMENTS OF PROPULSION: GAS TURBINES AND ROCKETS**, 978-1563477799, AIAA EDUCATION SERIES, 2006

GORDON C. OATES, **AEROTHERMODYNAMICS OF GAS TURBINE AND ROCKET PROPULSION**, 978-1563472411, AIAA EDUCATION SERIES, 1997

CLAUDIO MATAIX, **TURBOMÁQUINAS TÉRMICAS**, 978-8423707270, 3ª EDICIÓN, DOSSAT EDICIONES, 2011

BORJA GALMÉS BELMONTE, **MOTORES DE REACCIÓN Y TURBINAS DE GAS**, 978-8428341462, 2ª EDICIÓN, EDICIONES PARANINFO, 2018

ALLAN T. KIRKPATRICK, **INTERNAL COMBUSTION ENGINES APPLIED THERMOSCIENCES**, 978-1119454502, 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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen
- Estudo previo: preparación para o seguimento da materia, procura de información e preparación das probas de avaliación

* Metodoloxías docentes que se modifican
- Lección maxistral: docencia en aula virtual (campus remoto)
- Prácticas de laboratorio: prácticas informáticas a través da aula virtual (campus remoto) e resolución de problemas a través da aula virtual (campus remoto); anulación de saídas de estudo e anulación de prácticas de laboratorio

* Mecanismo non presencial de atención ao alumnado (titorías)
- Titorías en despacho virtual (campus remoto)

=== ADAPTACIÓN DA AVALIACIÓN ===
* Probas xa realizadas
- Mantense a calificación e a porcentaxe de peso para obter a nota final

* Probas pendentes que se manteñen
- Mantense a porcentaxe de peso para obter a nota final

* Probas que se modifican
- Nun escenario de docencia non presencial e sempre que non se permitan os exames escritos de xeito presencial, serán a través da aula virtual (campus remoto), consistente nunha serie de preguntas curtas e resolución de problemas

* Información adicional
- Nun escenario de docencia parcialmente presencial, os exames escritos serán de xeito presencial

IDENTIFYING DATA				
Deseño mecánico, MEF e vibracións				
Subject	Deseño mecánico, MEF e vibracións			
Code	O07G410V01932			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Fernández González, Santiago			
Lecturers	Fernández González, Santiago			
E-mail	santiago.fernandez.gonzalez2@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.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG2	Planificación, redacción, dirección e xestión de proxectos, cálculo e fabricación no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CE20	Coñecemento adecuado e aplicado á Enxeñaría de: A mecánica de fractura do medio continuo e as formulacións dinámicas, de fatiga de inestabilidade estrutural e de aeroelasticidad.
CE22	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos da mecánica de fluídos que describen o fluxo en todos os réximes, para determinar as distribucións de presións e as forzas sobre as aeronaves.
CE25	Coñecemento adecuado e aplicado á Enxeñaría de: os métodos de cálculo de deseño e proxecto aeronáutico; o uso da experimentación aerodinámica e dos parámetros máis significativos na aplicación teórica; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación, deseño, análise e interpretación de experimentación e operacións en voo; os sistemas de mantemento e certificación de aeronaves.
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT5	Capacidade de resolución de problemas e toma de decisións
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

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

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

Contidos	
Topic	
Deseño de sistemas mecánicos	- Introdución ao deseño mecánico. - Materiais, propiedades mecánicas, ensaios en laboratorio. - Teoría de mecanismos.
Elementos mecánicos	- Deseño de elementos mecánicos; eixes, 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 dinámia 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, amortecidas, 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. - Pulsaciós 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	50	70	120
Prácticas de laboratorio	21.5	0	21.5
Resolución de problemas	3.5	20	23.5
Informe de prácticas, prácticum e prácticas externas	0	60	60

*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	- Realización de problemas derivados da exposición teórica realizada.

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 dúbidas e dificultades relativas á realización de problemas prácticos propostos/expostos na aula. 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.

Avaliación

	Description	Qualification	Evaluated Competencess			
Resolución de problemas	Avaliaranse ós estudantes mediante exames a realizar durante o curso (avaluación continua) e exames finais.	85	CB2 CB3 CB5	CG1 CG2	CE20 CE22 CE25	CT3 CT4 CT5 CT6 CT8 CT11
Informe de prácticas, prácticum e prácticas externas	Avaliaranse os informes achegados polos estudantes da realización das prácticas en laboratorio.	15	CB2 CB3 CB5	CG1 CG2	CE20 CE22 CE25	CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

A materia aprobarase si se obten unha cualificación igual ou maior que un cinco como nota final, da seguinte forma:

1.- Para os alumnos que opten pola avaliación continua, a asistencia ao laboratorio, as memorías de cada práctica e os exames parciais terán unha valoración de 3 puntos na nota final, esta cualificación conservarase na convocatoria de

primeira oportunidade e na convocatoria de segunda oportunidade. As probas de avaliación continua realizaranse no horario lectivo.

2.- Os alumnos que non opten pola avaliación continua, a súa nota será a obtida no exame final proposto.

3.- O exame final da primeira e segunda oportunidade presentará duas partes:
a) 1ª parte, valorada con 7 puntos. Esta parte deberana de realizar todos os alumnos.
b) 2ª parte, valorada con 3 puntos. Esta parte deberana de realizar só os alumnos que non opten pola avaliación continua.
Sen menoscabo do anterior, os alumnos que vaian a avaliación continua poderán mellorar nota realizando de forma voluntaria a segunda parte do exame, sendo a súa nota final a mellor obtida.

4.- A avaliación en convocatoria fin de carreira farase mediante un exame teórico-práctico valorado sobre 10 puntos.

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 alumno 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 alumno no n 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

Plan de Continxencias

Description

Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dunha maneira mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

Adaptación das metodoloxías.

- Metodoloxías docentes que se manteñen.

Chegado o caso quedaría anulada a docencia presencial na aula e laboratorio, sustituindose por docencia non presencial vía telemática.

- Metodoloxías docentes que se modifican.

Impartición das clases de teoría e das prácticas de laboratorio mediante métodos telemáticos establecidos pola Universidade, a distancia online.

- Mecanismo non presencial de atención ao alumnado (titorías).

Titorías online, mediante plataforma informática da Universidade ou resolución de dúbidas vía email.

- Modificacións (se procede) dos contidos a impartir.

Non procede.

- Bibliografía adicional para facilitar o auto-aprendizaxe.

Bibliografía xa establecida e revisada na actual guía docente.

- Outras modificacións.

Chegado o caso, os docentes poderán pedir ao alumnado a entrega de traballos/memorías/boletíns de problemas... de partes concretas da materia co fin de promover o autoaprendizaxe e a busca de información. Estes traballos/memorías/boletíns tamén terán un peso concreto á hora da avaliación da materia e conservarase a nota na 2ª edición da acta.

Adaptación da avaliación.

1.- Prácticas de laboratorio, con entregables por parte do alumnado terá un peso dun 30% na nota final da materia. A nota conservarase na 2ª edición da acta.

2.- Entrega de traballos/memorías/boletíns de problemas por parte do alumnado terá un peso dun 30% na nota final da materia. A nota conservarase na 2ª edición da acta.

3.- Exame final. Terá un peso dun 40%.

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

IDENTIFYING DATA				
Space vehicles				
Subject	Space vehicles			
Code	O07G410V01933			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The space vehicles operate in a very different environment than the earth. This environment is critical when defining the design requirements of the space vehicles. In addition to the space environment, it is under the scope of this subject the study of the necessary concepts of orbital mechanics for the understanding of the main application orbits, maneuvers and perturbations of the space vehicles. Main subsystems of a space vehicle are studied, as well, with special attention to the subsystem of thermal control and the subsystem of attitude control. Labs are included using specific material and simulation software of mission analysis. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG1	Capabiliity for design, development and management in the field of aeronautical engineering (in according with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials , airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CG6	Capability to participate in flight testing programs for take-off and landing distances, ascent speeds, loss speeds, maneuverability and landing capacities.
CE24	Appropriate knowledge applied to engineering: systems of aircrafts and automatic systems of flight control of the aerospace vehicles.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT6	Capabiliity for interpersonal communication
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes	Competences			
- Knowledge, understanding, application and analysis of the basic configurations, subsystems and missions of the space vehicles	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13
- Capacity for the analysis of the mission, of the type of law of guided and space path	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13

- Knowledge, understanding, application and analysis of the thermal control of the space vehicle	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13
- Knowledge, understanding, application and analysis of control of attitude and orbit of the space vehicle	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13
- Knowledge and understanding of the system of essays and of the support of earth of the space vehicle	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13

Contents

Topic	
BLOCK 1: Introduction	Lesson 1.1: Brief historical review. Lesson 1.2: Classification of space vehicles Lesson 1.3: Types of subsystems of space vehicles Lesson 1.4: The solar system. Lesson 1.5: The space and planetary surroundings.
BLOCK 2: Orbital Mechanics	Lesson 2.1: Systems of reference and time. 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, commando and telemetry systems Lesson 4.6: Ground segment Lesson 4.7: Laboratory tests

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	0	28
Laboratory practical	12	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, preferably, by appointment, in the teacher's virtual office, on the Remote Campus.

Assessment

	Description	Qualification	Evaluated Competencess			
Laboratory practical	Laboratory report	10	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT11 CT13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT6 CT11 CT13
Objective questions exam	Partial examination of short questions and problems (20%) (Percentage can be divided into shorter tests) Final examination of short questions and problems (50%)	70	CB2 CB3 CB5	CG1 CG6	CE24	CT3 CT4 CT11 CT13

Other comments on the Evaluation

The evaluation of the course at the first opportunity will be carried out by Ongoing Assessment. Students who have a justification may officially waive the ongoing assessment and ask for a first oportunity final exam, on the official date. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory. The waiver of ongoing assessment must be made during the first month of class. During this period, the justification of the resignation will be presented to the coordinator of the subject for evaluation. If this justified resignation is not done, the calification reflected in the first call report will be "not presented".

To pass the course at the first opportunity, a score greater than 5 points out of 10 will be required in the continuous evaluation during the development of classes and the exam on the official date, toghether. The final grade will be obtained according to the indicated percentages.

Ongoing assessment is not passed in the following cases:

- The non-execution or delivery, without justification, of any of the items of the ongoing assessment (works reports, practicum reports, exams ...). In this case, the final grade reflected in the official record will be "not presented"

- Obtaining a grade of less than 5 points out of 10 in the final exam of ongoing assessment. In this case, the final grade reflected in the official record will be the grade of the ongoing assessment final exam.

The evaluation of the course in the second opportunity and end of studies will be carried out in a final exam on the date set by the center. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory.

To pass the subject in the second opportunity and end of studies, a score higher than 5 points out of 10 will be required in the exam on the official date.

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.

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

The maximum length of the exams will be 3 hours if there is no interruption, and 5 hours if there is an intermediate break (maximum 3 hours for each part).

Ongoing assessment evaluation activities will be carried out during official timetable hours.

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The proposed methodologies are maintained but carried out through the Remote Campus. The platform Moovi will be used more intensively as reinforcement to ensure accessibility of the students to the contents of the subject.

* Teaching methodologies modified
Laboratory practices that require interaction with physical elements are replaced by other activities that can be carried out on the remote campus, such as work in groups.

* Contactless mechanism for student attention (tutorials)
The tutorials will place in the teacher's virtual office on the remote campus.

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out
The tests already carried out maintain their weight in the evaluation.

* Pending tests
Pending tests are planned and will be carried out using the Moodle platform and the remote campus, and they maintain their weight in the evaluation.

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	Type	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.			

Competencias

Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CE24	Coñecemento adecuado e aplicado á Enxeñaría de: Os sistemas das aeronaves e os sistemas automáticos de control de voo dos vehículos aeroespaciais.
CE25	Coñecemento adecuado e aplicado á Enxeñaría de: os métodos de cálculo de deseño e proxecto aeronáutico; o uso da experimentación aerodinámica e dos parámetros máis significativos na aplicación teórica; o manexo das técnicas experimentais, equipamento e instrumentos de medida propios da disciplina; a simulación, deseño, análise e interpretación de experimentación e operacións en voo; os sistemas de mantemento e certificación de aeronaves.
CE26	Coñecemento aplicado de: aerodinámica; mecánica e termodinámica, mecánica do voo, enxeñaría de aeronaves (á fixa e ás rotatorias), teoría de estruturas.
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos

Resultados de aprendizaxe

Learning outcomes	Competences		
Coñecemento, comprensión, aplicación, análise e síntese dos métodos de cálculo de deseño e proxecto de aeronaves de á fixa	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6 CT8 CT11
Coñecemento aplicado dos sistemas das aeronaves	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6 CT8 CT11
Coñecemento, comprensión, aplicación, da aerodinámica dos rotores, as actuacións e a estabilidade e controlabilidade das aeronaves das aeronaves de ás rotatorias	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6 CT8 CT11
Coñecemento dos aspectos máis destacados das calidades de voo e os ensaios en voo das aeronaves de ás rotatorias	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6 CT8 CT11

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
Exame de preguntas obxectivas	1	0	1
Exame de preguntas de desenvolvemento	2	0	2
Presentación	0.5	0	0.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	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	Evaluated Competencess		
Aprendizaxe baseado en proxectos	Realización dun proxecto de deseño de aeronave de á fixa ou rotatoria	30	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6 CT8 CT11
Prácticas de laboratorio	Resolución de problemas e casos prácticas expostos nas sesións de prácticas	15	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT8
Exame de preguntas obxectivas	Exame tipo test	20	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT8 CT11
Exame de preguntas de desenvolvemento	Exame de problemas	30	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT8
Presentación	Presentación en clase do traballo grupal desenvolvido.	5	CB2 CB3 CB5	CE24 CE25 CE26	CT3 CT4 CT6

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 materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, no exame final de avaliación continua, non inferior a 4.0.

-Entregar todas as 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 4.0.

(2) Estudante que, tras unha autorización por parte do profesorado, desexen ser avaliados mediante avaliación única:

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua.

Os estudantes que teñan unha xustificación poderán 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 alumno deberá superar o 5 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

A renuncia á avaliación continua debe facerse durante o primeiro mes de clase. Durante este período, presentarase o xustificante ao coordinador da materia para a súa avaliación.

Segunda oportunidade e Fin de Carreira

Os alumnos que non superasen a materia na primeira oportunidade poderán 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 copia 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

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID-19, a Universidade establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno, atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial.

Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dunha maneira mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado, e o profesorado, a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

Escenario de docencia mixta

Debido á situación excepcional, ante a imposibilidade de poder impartir a docencia dun modo totalmente presencial, utilizaranse medios virtuais tanto síncronas como asíncronas para a impartición das clases que sexan habilitadas pola Universidade de Vigo.
As prácticas serán entregadas polos estudantes e avaliadas empregando os recursos das plataforma de teledocencia dispoñible no seu momento.
As sesións de titorización, tanto o nivel individual como o nivel de grupos poderán realizarse por medios telemáticos (correo

electrónico, videoconferencia, salgas/aulas/despachos virtuais proporcionadas pola Universidade de Vigo).

=== ADAPTACIÓN DAS METODOLOXÍAS ===
As metodoloxías docentes mantéñense principalmente cunha posible modificación temporal na planificación segundo a situación concreta.
Non procede ningunha modificacións dos contidos para impartir.
Auméntase a bibliografía co material de elaboración propia (por exemplo, guías de traballo, vídeos e textos explicativos, problemas resoltos, etc.) para facilitar a auto-aprendizaxe.

=== ADAPTACIÓN DA AVALIACIÓN ===
As probas mantéñense coas súas ponderacións previstas.

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	Type	Year	Quadmester
	9	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Gómez San Juan, Alejandro Manuel Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	Airworthiness is the ability of aircraft to fly. This quality is ensured through certification, which is made up of a set of tasks that guarantee that the aircraft is in safe conditions for the flight. To ensure that these conditions are maintained over time, we must speak of continuing airworthiness, that is, all the revisions, modifications and maintenance tasks necessary to maintain airworthiness over time. This subject deals with the procedures that affect airworthiness, basically analyzing the EASA and FAA regulations. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG3	Installation, operation and maintenance in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, infrastructures and airports, air navigation infrastructures and space management, air traffic and transport management systems.
CG4	Verification and certification in the field of aeronautical engineering that aim, in accordance with the knowledge acquired (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, aerospace propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE21	Appropriate knowledge applied to engineering: foundations of sustainability, maintenance and operation of aerospace vehicles.
CE25	Appropriate knowledge applied to engineering: methods of design calculations and aeronautical projects; use of aerodynamic experimentation and the most significant parameters in the theoretical application; management of experimental techniques, equipment and measuring instruments; simulation, design, analysis and interpretation of experimentation and operations in flight; systems of maintenance and certification of aircrafts.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes	
Learning outcomes	Competences

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

Contents

Topic	
Block 1: Certification	Unit 1.1: Introduction and concepts Unit 1.2: Organizations competent in 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
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	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, preferably, by appointment, in the teacher's virtual office, on the Remote Campus.

Assessment

Description	Qualification	Evaluated Competences

Laboratory practical	Laboratory report	10	CB2 CB3 CB5	CG3 CG4	CE21 CE25	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	CB2 CB3	CG3 CG4	CE21 CE25	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Objective questions exam	Partial eliminatory exam Certification of short questions and problems (35%)* Final exam Maintenance of short questions and problems (35%) * In case of failing the first partial eliminatory exam, the exam must be done again on the date of the final exam.	70	CB2 CB3 CB5	CG3 CG4	CE21 CE25	CT3 CT4 CT5 CT8 CT11 CT13

Other comments on the Evaluation

The evaluation of the course at the first opportunity will be carried out by Ongoing Assessment. Students who have a justification may officially waive the ongoing assessment and ask for a first oportunity final exam, on the official date. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory. The waiver of ongoing assessment must be made during the first month of class. During this period, the justification of the resignation will be presented to the coordinator of the subject for evaluation. If this justified resignation is not done, the calification reflected in the first call report will be "not presented".

To pass the course at the first opportunity, a score greater than 5 points out of 10 will be required in the continuous evaluation during the development of classes and the exam on the official date, toghether. The final grade will be obtained according to the indicated percentages.

Ongoing assessment is not passed in the following cases:

- The non-execution or delivery, without justification, of any of the items of the ongoing assessment (works reports, practicum reports, exams ...). In this case, the final grade reflected in the official record will be "not presented"

- Obtaining a grade of less than 5 points out of 10 in the final exam of ongoing assessment. In this case, the final grade reflected in the official record will be the grade of the ongoing assessment final exam.

The evaluation of the course in the second opportunity and end of studies will be carried out in a final exam on the date set by the center. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory.

To pass the subject in the second opportunity and end of studies, a score higher than 5 points out of 10 will be required in the exam on the official date.

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.

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

The maximum length of the exams will be 3 hours if there is no interruption, and 5 hours if there is an intermediate break (maximum 3 hours for each part).

Ongoing assessment evaluation activities will be carried out during official timetable hours.

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The proposed methodologies are maintained but carried out through the Remote Campus. The platform Moovi will be used more intensively as reinforcement to ensure accessibility of the students to the contents of the subject.

* Teaching methodologies modified
Laboratory practices that require interaction with physical elements are replaced by other activities that can be carried out on the remote campus, such as work in groups.

* Contactless mechanism for student attention (tutorials)
The tutorials will place in the teacher's virtual office on the remote campus.

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out
The tests already carried out maintain their weight in the evaluation.

* Pending tests
Pending tests are planned and will be carried out using the Moodle platform and the remote campus, and they maintain their weight in the evaluation.

IDENTIFYING DATA				
Numerical calculation				
Subject	Numerical calculation			
Code	O07G410V01941			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cid Iglesias, María Begoña			
Lecturers	Cid Iglesias, María Begoña			
E-mail	bego@dma.uvigo.es			
Web	http://aero.uvigo.es			
General description	The objective of this subject is that the students know and master different techniques and methods necessary for other subjects as well as for professional practice: the main numerical methods to solve large linear and non-linear systems, initial value and contour problems and the application of the finite element method. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CG2	Planning, documentation, project management, calculation and manufacturing in the field of aeronautical engineering (in accordance with what is established in section 5 of order CIN / 308/2009), aerospace vehicles, propulsion systems, aerospace materials, airport infrastructures, air navigation infrastructures and space management, air traffic and transport management systems.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies

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

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

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

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

Assessment		
Description	Qualification	Evaluated Competencess

Problem solving	Realization in an autonomous way of a collection of problems of each block of contents. LO1	30	CB2 CB3 CB5	CG2	CE32	CT3 CT4 CT5 CT6 CT8 CT11
Practices through ICT	Assistance and correct realisation of the practices by means of computer programs. LO1, LO2	20	CB3 CB5	CG2	CE32	CT4 CT5 CT8
Essay questions exam	Realization of a final exam in which they collect the corresponding contents to the master sessions and to the resolution of problems. LO1	50	CB2 CB3 CB5	CG2	CE32	CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

In case of not attending class in person, mixed or non-face-to-face teaching, in order to be eligible for the evaluation it is essential to upload an updated photo to the platform in order to identify the students.

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

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

Second chance evaluation (attendees):

The evaluation system for the second call is the same as for the first, with the grades obtained being maintained for practices with computer programs. If the student has not reached a 5 out of 10 in the laboratory practices he/she must take an additional test to pass this part, which represents 20% of the final grade. The exam will be marked out of 10 and will represent 80% of the final qualification.

Evaluation procedure for non-attendees (any call):

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

Practical evaluation of computer practices: It is essential to perform this test to pass the subject. It will consist of a practical examination on the topics covered in the computer practices during the course. 5 out of 10 must be obtained to compute with the theoretical part. Rating: 20%

Evaluation dates:

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

It expects that the students present a suitable ethical behaviour. In case to detect an ethical behaviour no suitable (copy, plagiarism, utilisation of electronic devices non authorised, and others) will consider that the/the student/to does not gather the necessary requirements to surpass the subject. In this case the global qualification in the present academic course will be of suspense (0.0).

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

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

Sources of information

Basic Bibliography

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

Kreyszig, E., **Advanced engineering mathematics**, Wiley,

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

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

Complementary Bibliography

Chapra, S., Canale, R., **Métodos numéricos para ingenieros**, McGraw-Hill,
Conde, L.; Winter,G., **Métodos y algoritmos básicos del álgebra numérica**, Reverté,
Grau, J. - Torres, R., **Introducción a la mecánica de fluidos y transferencia de calor con COMSOL 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

Contingency plan

Description

In the event of exceptional circumstances:

Elearning platforms/tools
Online tuition will be supported by Campus Remoto and Moovi. Other supplementary platforms may be used to guarantee the accessibility to teaching content.

Tutoring sessions
Tutoring sessions may be carried out online: either asynchronously (e-mail, Moovi, forums, etc.) or by videoconference, in this case by appointment.

Assessment
Exams will be face-to-face unless academic authorities indicate otherwise. In any case, all the comments included in the Assessment section remain valid.

IDENTIFYING DATA				
Aerospace alloys and compound materials				
Subject	Aerospace alloys and compound materials			
Code	O07G410V01942			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Optional	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Pena Uris, Gloria María			
Lecturers	Álvarez González, David Pena Uris, Gloria María			
E-mail	gpena@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.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE11	Understand the technological benefits, the techniques of optimization of the materials and the modification of their properties through treatments.
CE19	Applied knowledge of: science and technology of materials; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation and air traffic systems; aerospace technology; theory of structures; airborne transportation; economy and production; projects; environmental impact.
CE30	Appropriate knowledge applied to engineering: technological benefits, techniques of optimization of the materials used in the aerospace sector and the processes of treatments to modify their mechanical properties.
CE32	Appropriate knowledge applied to engineering: methods of calculation and development of materials and defence systems; management of experimental techniques, equipment and measuring instruments; numerical simulation of the most significant physical-mathematical processes; inspection, quality control and fault detection techniques; their most appropriate methods and repair techniques.
CE33	Applied knowledge of aerodynamics, flight mechanics, air defense engineering (ballistics, missiles and air systems), space propulsion, material science and technology, structure theory.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes			
Learning outcomes	Competences		
Knowledge, understanding and application of the materials employed in the aerospace sector: capacity to identify his differences.	CB3	CE11 CE19 CE30 CE33	CT4 CT8 CT11 CT13

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

Contents	
Topic	
Lesson 1.- 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	45	119	164
Mentored work	1	20	21
Studies excursion	8	0	8
Laboratory practical	14	2	16
Problem solving	3.5	5	8.5
Objective questions exam	2	0	2
Presentation	0.5	3	3.5
Portfolio / dossier	0	1	1

*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	Evaluated Competencess		
Problem solving	Throughout the course, students will carry out a series of online 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	CB2 CB5	CE30	CT4 CT8
Objective questions exam	Written individual exam in which the student will answer solme questions related to the subject presented in the classroom, demonstrating good understanding of the basic concepts, ability to organize the information and to connect concepts	50	CB2 CB3	CE32	CT4 CT8
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	25	CB2 CB3 CB5		CT4 CT5 CT8 CT11 CT13
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.	15	CB3 CB5	CE32 CE33	CT5 CT8 CT11 CT13

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 50% of the total grade, will consist of activities performed throughout the entire semester (Online questionnaires: 10%; Individual or group work: 25%; Portfolio: 15%).Face-to-face presentation will be held during school hours*

*- The **written exam** (50%) 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 40% in each one of the assessment types (2.4 / 6 in the continuous assessment and 1.6 / 4 in the written exam). If this criterion is not reached, the maximum grade that the student can achieve is a 4/10.

***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.*

In the case of students who have not attended the course, grading will be based on the mark obtained in a final exam that wiill evaluate the learning outocomes and skills of the course, with 100% of the score.

***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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
All the lecture-based sessions will be maintained, moving them totally or partially to an online version, through the Online Campus (Campus Remoto) of the UVigo.

* Teaching methodologies modified
Laboratory sessions will be modified to adapt the group size to that set by the University or the EEI as safe. Sessions will be organized to ensure the safety distance. All the activities that can be performed in non face-to-face mode will be deployed on online platforms.
In the case of total suspension of face-to-face teaching, alternative activities that allow covering the contents of the practical part of the subject will be provided: virtual tools, videos, etc.
- The defense of the work considered in the continuous assessment will be carried out preferably face-to-face. If this is not possible, it will be performed through the Virtual Campus

* Non-attendance mechanisms for student attention (tutoring)
Non-face-to-face tutorial services will be held through the virtual offices on the Virtual Campus, expanding the office-hours to encourage student participation. Student attention may be carried out also by other ways (email, videoconference, FAITIC forums, ...), always after previous agreement with the teacher.

* Modifications (if applicable) of the contents
According to the moment when the University decision of starting non-face-to face or mix teaching is made, modification in the lab contents will need to be done, following the defined organization. Students will be informed of the changes through FAITIC platform (see Adaptation of Assessment section)

* Additional bibliography to facilitate self-learning
Althoug additional bilbiography is already indicated at the end of each lesson, if student access to academic libraries is limited, additional documentation will be provided.

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
The marks obtained in the continuous assessment tests already performed will maintain their weight in the final grade without changes, as defined in the teaching guide.

* Pending tests that are maintained
Those continuous assessment tests or exams that have not yet been done will also maintain their contribution in the final grade, as defined in the teaching guide.

* Tests that are modified
Despite the change in the fase-to-face/virtuallity of the assessment exams, the weight in the course grade indicated in the teaching guide will not change, except in the exceptional situation in which none of the lab sessions, or visits to the aeronautical companies coudl be carried out.
In this case, as the substitute activities will involve a greater workload on the part of the students, will be taken into account with 20% of the grade at the expense of areduction in the weight of the written exam from 40% to 30%.

* New tests
In the exceptional case indicated above, a new online test will be carried out to assess the knowledge acquired in the activities that substitute lab sessions. This new test, that replace the portfolio, will consist of short questions and exercises and will be valued with 20%.

* Additional Information
In any case, the requirement of achieving a minimum mark of 40% in both the continuous assessment and the written exam remains the same.

IDENTIFYING DATA				
Analytic and orbital mechanics				
Subject	Analytic and orbital mechanics			
Code	O07G410V01943			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	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.			

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

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

Knowledge and understanding of the dynamics of attitude of the space vehicles	CB2 CB3 CB5	CG6	CE24 CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11

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

Planning	Class hours	Hours outside the classroom	Total hours
Problem solving	12	18	30
Practices through ICT	12	18	30
Lecturing	26	39	65
Essay questions exam	2.5	0	2.5
Report of practices, practicum and external practices	0	22.5	22.5

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

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

Personalized assistance

Methodologies	Description
Problem solving	The student will participate in the process of solving problems under the supervision of the teacher.
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	Evaluated Competencess			
Problem solving	Assistance and active participation in the classes of problem solving	5	CB2 CB3 CB5	CG6	CE24 CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11
Practices through ICT	Assistance and active participation in the computer practices	5	CB2 CB3 CB5	CG6	CE24 CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11

Essay questions exam	Exam	60	CB2 CB3 CB5	CG6	CE24 CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11
Report of practices, practicum and external practices	Elaboration of a report describing the methodology and the results of the computer practices	30	CB2 CB3 CB5	CG6	CE24 CE26 CE33	CT3 CT4 CT5 CT6 CT8 CT11

Other comments on the Evaluation

The evaluations of the continuous assessment will be realized during the classes.

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

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

Sources of information

Basic Bibliography

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

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

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

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

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

William T. Thomson, **Introduction to Space Dynamics**, Dover Publications, 1985

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained
In the event that they cannot be given face-to-face, the master classes and problem solving classes will be taught by "Campus remoto" or by Microsoft Teams. These means, along with email, will also be used for interaction with students for the numerical practice exercises.

* Teaching methodologies modified
See above.

* Non-attendance mechanisms for student attention (tutoring)
The tutorials, in the case that they have to be non-face-to-face, will be held by email, by "Campus Remoto", or by Microsoft Teams, subject to prior agreement with the students.
* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests that are maintained
The continuous evaluation of the active participation in the classes and in the practices [total weight 10%] and of the memories of numerical practices [total weight 30%] will be maintained.

* Tests that are modified
In the case of not being allowed to do it face-to-face, the written exam will be done by email in a limited time (each student will have a different text) and will weigh 30%
* New tests
In the case of not being allowed to have face-to-face written exams, there will be an oral exam that will consist of two parts:
1. Individual oral presentation by videoconference of the report of the numerical calculation practices [weight 10%];
2. Individual presentation in videoconference with support in powerpoint, pdf, or another similar method of an individual work on an aspect of Orbital Mechanics (with the possibility of questions) [weight 20%]

IDENTIFYING DATA				
Control and optimization				
Subject	Control and optimization			
Code	O07G410V01944			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	García Rivera, Matías			
Lecturers	García Rivera, Matías			
E-mail	mgrivera@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The aim of this subject is to present different technics of analysis and design of control systems, using classical and modern control. The technics of optimization are applied in problems of design. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CE31	Appropriate knowledge applied to engineering: physical phenomena of air defense systems, their qualities and their control, stability and automatic control systems.
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT8	Capabiliity for critical and self-critical reasoning
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

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

Contents
Topic
Introduction to optimization
Methods of multidimensional optimization
Optimization with constraints
Discrete and sampled systems
Design of PID controllers
State-Space
Linear-quadratic controller
State Estimation
Linear-quadratic gaussian controller
Minimum variance control

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	0	18
Autonomous problem solving	0	87.5	87.5
Lecturing	32	0	32
Report of practices, practicum and external practices	0	10	10
Essay questions exam	2.5	0	2.5

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

Methodologies	
	Description
Laboratory practical	Once developed the contents of theory and corresponding problems, students will make practices of laboratory.
Autonomous problem solving	Once developed the contents of theory and corresponding problems, students will resolve problems of autonomous form.
Lecturing	The lecturer will explain the main of the contents of the matter. Active participation of the students is required.

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

Assessment					
	Description	Qualification	Evaluated Competencess		
Laboratory practical	In this test concepts given in practices of laboratory will be evaluated. Learning outcomes evaluated RA01.	30	CB2 CB3 CB5	CE31	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Autonomous problem solving	The delivery of solutions to a set of exercises proposed evaluates the resolution of problems and/or exercises of autonomous form. Learning outcomes evaluated RA01.	5	CB2 CB3 CB5	CE31	CT3 CT4 CT5 CT6 CT8 CT11 CT13
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	CB2 CB3 CB5	CE31	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Essay questions exam	This test evaluates theoretical concepts and the resolution of problems. Learning outcomes evaluated RA01.	60	CB2 CB3 CB5	CE31	CT3 CT4 CT5 CT6 CT8 CT11 CT13

Other comments on the Evaluation

All references to numerical grades in this guide are about 10.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GRADING PROCESS

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

PROHIBITION OF USE OF ANY ELECTRONIC DEVICE

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

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

Sources of information
Basic Bibliography
Domínguez, S.; Campoy, P.; Sebastián, J.M.; Jiménez, A., **CONTROL EN EL ESPACIO DE ESTADO**, 978-84-8322-297-3, 2a, Pearson Educación S.A., Madrid,, 2006
K. OGATA, **Ingeniería de control moderna**, 5a, PRENTICE-HALL, 2010
B. C. KUO, **Sistemas de control automático**, 7a, PRENTICE HALL, 1996
R. FLETCHER, **Methods of Optimization**, John Wiley & Sons, 2007
Complementary Bibliography
Moreno, Garrido, Balaguer, **Ingeniería de Control: modelado y control de sistemas dinámicos**, Ariel, 2003

Recommendations

Subjects that it is recommended to have taken before

Electronics and automation/O07G410V01403

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

SCENARIO 1: MIXED TEACHING
Due to the exceptional situation, given the impossibility of being able to teach completely in person, virtual means will be used to teach non-contact classes.
For the non-presential part, the means provided by the University, currently the https://campusremotouvigo.gal/ and moovi.uvigo.gal, will be used. It may also be supplemented by other means.

SCENARIO 2: NON-PRESENCE TEACHING
Due to the exceptional situation, given the impossibility of being able to teach completely in person, virtual means will be used to teach non-contact classes.
For the non-presential part, the means provided by the University, currently the https://campusremotouvigo.gal/ and moovi.uvigo.gal, will be used. It may also be supplemented by other means.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
All of them

* Teaching methodologies modified
None of them

* Non-attendance mechanisms for student attention (tutoring)
https://campusremotouvigo.gal/ and moovi.uvigo.gal

* Modifications (if applicable) of the contents
No modifications

* Additional bibliography to facilitate self-learning
No additional bibliography

* Other modifications
For laboratory practices, the practices that require specific equipment will be replaced by another simulated or virtualized one. Eventually, alternative practices that do not require such equipment will be proposed. These practices may be an autonomous format in anticipation of reconciliation and / or connectivity problems.

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
All tests already carried out maintain their weight

* Pending tests that are maintained
All pending tests maintain their weight

* Tests that are modified
No tests are modified

* New tests

No new test

* Additional Information
Due to the exceptional situation, due to the impossibility of being able to do the tests in person, virtual means will be used to carry out the tests.
The means provided by the University, currently https://campusremotouvigo.gal/ and moovi.uvigo.gal/ will be used. They may also be supplemented by other means.

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

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

Learning outcomes	Competences			
- To know the propulsive needs of aircraft.	CB2 CB3 CB5	CG1	CE29 CE33	CT3 CT4 CT5 CT6 CT8 CT11 CT13

- To know the thrusts and resistances related to the jet engines.	CB2 CB3 CB5	CG1	CE29	CT3 CT4 CT5 CT6 CT8 CT11 CT13
- To know and quantify in an applied way the combustion process of the jet engines and the combustion efficiency.	CB2 CB3 CB5	CG1	CE29	CT4 CT5 CT8 CT11 CT13
- To know how to perform an energy balance by differentiating and calculating the returns involved.	CB2 CB3 CB5	CG1	CE29	CT4 CT5 CT8 CT11 CT13
- 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.	CB2 CB3 CB5	CG1	CE29	CT4 CT5 CT8 CT11 CT13
- To know the different jet engines and know how to obtain the optimal systems from the point of view of propulsive.	CB2 CB3 CB5	CG1	CE29	CT3 CT4 CT5 CT11 CT13
- To size the components that intervene in the propulsive system.	CB2 CB3 CB5	CG1	CE33	CT4 CT5 CT8
- To use computer tools to calculate the performance of air-reactors.	CB2 CB3 CB5	CG1	CE29	CT4 CT5 CT8
- To know the effect of flight conditions: speed and altitude in the operation of the air-reactors.	CB2 CB3 CB5	CG1	CE33	CT4 CT8
- To know the environmental problems of the jet engines and their possible solutions.	CB2 CB3 CB5	CG1	CE29	CT4 CT13
- To write technical reports and make oral technical presentations related to the above.	CB2 CB3 CB5	CG1	CE29 CE33	CT3 CT6 CT8 CT11 CT13
- To solve problems derived from the field of the subject in an autonomous way and in collaboration with others.	CB2 CB3 CB5	CG1	CE29 CE33	CT5 CT6 CT8
- 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.	CB2 CB3	CG1	CE29	CT4 CT8
- Knowledge, understanding, application and analysis of the ideal model of the rocket engines with fluid dynamics propulsion and the influence of real effects.	CB2 CB3 CB5	CG1	CE29 CE33	CT4 CT5 CT8
- Knowledge of the propellants and understanding and the combustion process of the rocket motors of solid, liquid and hybrid propellants.	CB2 CB3 CB5	CG1	CE29	CT4 CT8
- Knowledge, understanding, application and analysis of the ionization and acceleration system of electric rocket motors.	CB2 CB3 CB5	CG1	CE33	CT4 CT8
- Knowledge, understanding, application and analysis of the feeding and cooling systems.	CB2 CB3 CB5	CG1	CE33	CT4 CT8
- 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.	CB2 CB3 CB5	CG1	CE29 CE33	CT4 CT5 CT8

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 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 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, preferably, by appointment, in the teacher's virtual office, on the Remote Campus.

Assessment

	Description	Qualification	Evaluated Competencess			
Laboratory practical	Laboratory report	10	CB2 CB3 CB5	CG1	CE29 CE33	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Mentored work	Reports and presentations of the work proposed during the course of the course within the practical sessions	20	CB2 CB3 CB5	CG1	CE29 CE33	CT3 CT4 CT5 CT6 CT8 CT11 CT13
Objective questions exam	Partial exam of short questions and problems (20%) (Percentage can be divided into shorter tests) Final exam of short questions and problems (50%)	70	CB2 CB3 CB5	CG1	CE29 CE33	CT3 CT4 CT5 CT8 CT11 CT13

Other comments on the Evaluation

The evaluation of the course at the first opportunity will be carried out by Ongoing Assessment. Students who have a justification may officially waive the ongoing assessment and ask for a first oportunity final exam, on the official date. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory. The waiver of ongoing assessment must be made during the first month of class. During this period, the justification of the resignation will be presented to the coordinator of the subject for evaluation. If this justified resignation is not done, the calification reflected in the first call report will be "not presented".

To pass the course at the first opportunity, a score greater than 5 points out of 10 will be required in the continuous evaluation during the development of classes and the exam on the official date, toghether. The final grade will be obtained according to the indicated percentages.

Ongoing assessment is not passed in the following cases:

- The non-execution or delivery, without justification, of any of the items of the ongoing assessment (works reports, practicum reports, exams ...). In this case, the final grade reflected in the official record will be "not presented"

- Obtaining a grade of less than 5 points out of 10 in the final exam of ongoing assessment. In this case, the final grade reflected in the official record will be the grade of the ongoing assessment final exam.

The evaluation of the course in the second opportunity and end of studies will be carried out in a final exam on the date set by the center. The grade obtained in this exam will represent 100% of the final grade. This exam may have a part to do in a computer room and / or laboratory.

To pass the subject in the second opportunity and end of studies, a score higher than 5 points out of 10 will be required in the exam on the official date.

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.

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

The maximum length of the exams will be 3 hours if there is no interruption, and 5 hours if there is an intermediate break (maximum 3 hours for each part).

Ongoing assessment evaluation activities will be carried out during official timetable hours.

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in

advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The proposed methodologies are maintained but carried out through the Remote Campus. The platform faitic will be used more intensively as reinforcement to ensure accessibility of the students to the contents of the subject.

* Teaching methodologies modified
Laboratory practices that require interaction with physical elements are replaced by other activities that can be carried out on the remote campus, such as work in groups.

* Contactless mechanism for student attention (tutorials)
The tutorials will place in the teacher's virtual office on the remote campus.

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out
The tests already carried out maintain their weight in the evaluation.

* Pending tests
Pending tests are planned and will be carried out using the Moodle platform and the remote campus, and they maintain their weight in the evaluation.

IDENTIFYING DATA				
Vehículos aeroespaciais				
Subject	Vehículos aeroespaciais			
Code	O07G410V01946			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	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.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CG1	Capacidade para o deseño, desenvolvemento e xestión no ámbito da enxeñaría aeronáutica que teñan por obxecto, de acordo cos coñecementos adquiridos segundo o establecido no apartado 5 da orde CIN/308/2009, os vehículos aeroespaciais, os sistemas de propulsión aeroespacial, os materiais aeroespaciais, as infraestruturas aeroportuarias, as infraestruturas de *aeronavegación e calquera sistema de xestión do espazo, do tráfico e do transporte aéreo.
CG6	Capacidade para participar nos programas de probas en voo para a toma de datos das distancias de despegamento, velocidades de ascenso, velocidades de perdas, maniobrabilidad e capacidades de aterraxe.
CE27	Coñecemento adecuado e aplicado á Enxeñaría de: Os fundamentos de sustentabilidade, mantenibilidade e operatividade dos sistemas espaciais.
CE32	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.
CE33	Coñecemento aplicado de: aerodinámica; mecánica do voo, enxeñaría da defensa aérea (balística, mísiles e sistemas aéreos), propulsión espacial, ciencia e tecnoloxía dos materiais, teoría de estruturas.
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT6	Capacidade de comunicación interpersoal
CT8	Capacidade de razoamento crítico e autocrítico
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
CT13	Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos

Resultados de aprendizaxe				
Learning outcomes	Competences			
Coñecemento, comprensión, aplicación e análise do deseño preliminar de aeronaves.	CB2 CB3 CB5	CG1 CG6	CE27 CE32 CE33	CT3 CT4 CT6 CT8 CT11 CT13
Coñecemento, comprensión e aplicación das configuracións, subsistemas e misións dos mísiles e vehículos espaciais.	CB2 CB3 CB5	CG1 CG6	CE27 CE32 CE33	CT3 CT4 CT6 CT8 CT11 CT13

Coñecemento, comprensión, aplicación e análise do deseño aerodinámico e guiado de mísiles e vehículos espaciais.	CB2 CB3 CB5	CG1	CE27 CE32 CE33	CT3 CT4 CT6 CT8 CT11 CT13

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	26	52	78
Resolución de problemas	10	31.5	41.5
Prácticas de laboratorio	14	14	28
Exame de preguntas obxectivas	0.5	0	0.5
Exame de preguntas de desenvolvemento	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 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 dunha práctica programada relacionada cun subsistema de vehículo espacial. A realización da práctica require a preparación da mesma, a asistencia e a realización dun informe por parte do alumnado

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	Evaluated Competencess

Prácticas de laboratorio	Avaliación da realización do informe.	30	CB3 CB5	CG1 CG6	CE27 CE32	CT11
Exame de preguntas obxectivas	Resolución de problemas e/ou preguntas conceptuais sobre os contidos da materia	35	CB2 CB3 CB5	CG1 CG6	CE27 CE32 CE33	CT3 CT4 CT8 CT11 CT13
Exame de preguntas de desenvolvemento	Examen de problemas	35	CB2 CB3 CB5	CG1 CG6	CE27 CE32 CE33	CT3 CT4 CT8 CT11 CT13

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 materia na primeira oportunidade, mediante Avaliación Continua, será necesario:

-Unha nota, no exame final de avaliación continua, non inferior a 4.0.

-Entregar todas as 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 4.0.

(2) Estudante que, tras unha autorización por parte do profesorado, desexen ser avaliados mediante avaliación única:

A avaliación do curso na primeira oportunidade realizarase, por defecto, mediante Avaliación Continua.

Os estudantes que teñan unha xustificación poderán 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 alumno deberá superar o 5 neste exame. Este exame pode ter unha parte para realizar nunha sala de computadores e / ou laboratorio.

A renuncia á avaliación continua debe facerse durante o primeiro mes de clase. Durante este período, presentarase o xustificante ao coordinador da materia para a súa avaliación.

Segunda oportunidade e Fin de Carreira

Os alumnos que non superasen a materia na primeira oportunidade poderán 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 copia 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

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

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

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

Complementary Bibliography

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

Recomendacións

Subjects that are recommended to be taken simultaneously

Control e optimización/O07G410V01944

Subjects that it is recommended to have taken before

Mecánica analítica e orbital/O07G410V01943

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID-19, a Universidade establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno, atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial.

Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dunha maneira mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado, e o profesorado, a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

Escenario de docencia mixta

Debido á situación excepcional, ante a imposibilidade de poder impartir a docencia dun modo totalmente presencial, utilizaranse medios virtuais tanto síncronas como asíncronas para a impartición das clases que sexan habilitadas pola Universidade de Vigo.
As prácticas serán entregadas polos estudantes e avaliadas empregando os recursos das plataforma de teledocencia dispoñible no seu momento.
As sesións de titorización, tanto o nivel individual como o nivel de grupos poderán realizarse por medios telemáticos (correo electrónico, videoconferencia, salgas/aulas/despachos virtuais proporcionadas pola Universidade de Vigo).

=== ADAPTACIÓN DAS METODOLOXÍAS ===
As metodoloxías docentes mantéñense principalmente cunha posible modificación temporal na planificación segundo a situación concreta.
Non procede ningunha modificacións dos contidos para impartir.
Auméntase a bibliografía co material de elaboración propia (por exemplo, guías de traballo, vídeos e textos explicativos, problemas resoltos, etc.) para facilitar a auto-aprendizaxe.

=== ADAPTACIÓN DA AVALIACIÓN ===
As probas mantéñense coas súas ponderacións previstas.

IDENTIFYING DATA				
Prácticas en empresas				
Subject	Prácticas en empresas			
Code	O07G410V01981			
Study programme	Grao en Enxeñaría Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Martín Ortega, Elena Beatriz			
Lecturers	Martín Ortega, Elena Beatriz			
E-mail	emortega@uvigo.es			
Web	http://http://aero.uvigo.es/			
General description	Mediante a realización de prácticas en empresa o estudante poderá aplicar as competencias e coñecementos adquiridos ao o longo dos seus estudos, permitindo reforzar a súa formación e facilitar a súa incorporación ao mercado laboral.			

Competencias	
Code	
CB2	Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado
CB5	Que os estudantes desenvolvesen aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía
CE6	Coñecemento adecuado do concepto de empresa, marco institucional e xurídico da empresa. Organización e xestión de empresas.
CE19	Coñecemento aplicado de: a ciencia e tecnoloxía dos materiais; mecánica e termodinámica; mecánica de fluídos; aerodinámica e mecánica do voo; sistemas de navegación e circulación aérea; tecnoloxía aeroespacial; teoría de estruturas; transporte aéreo; economía e produción; proxectos; impacto ambiental.
CT2	Liderado, iniciativa e espírito emprendedor
CT3	Capacidade de comunicación oral e escrita na lingua nativa
CT4	Capacidade de aprendizaxe autónoma e xestión da información
CT11	Ter motivación pola calidade con sensibilidade cara a temas do ámbito dos estudos
CT12	Compromiso ético e democrático

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecemento, comprensión e aplicación da organización e planificación dunha empresa ou institución do sector aeroespacial.		CE6	
Coñecemento, comprensión e aplicación dos equipos de traballo, do traballo en equipo e da comunicación oral e escrita en empresas e institucións do sector aeroespacial, nacionais ou estranxeiras	CB3 CB4 CB5		CT2 CT3 CT4 CT11 CT12
Coñecemento, comprensión, aplicación, análise e síntese de distintos problemas técnicos concretos que aparecen nas empresas, aplicando con creatividade os coñecementos adquiridos na carreira	CB2	CE19	CT12

Contidos
Topic

Coñecemento xeral por parte do estudante da organigrama e das liñas de actividade da empresa ou institución.	- Visita ás instalacións. - Familiarización coa instrumentación, ferramentas, linguaxes de programación e paquetes de software usuais. - Asignación do estudante a un grupo de traballo. - Asignación ao estudante dun paquete de traballo concreto, correspondente a un dos traballos activos da empresa ou a unha das súas liñas de I+D+i, co seu correspondente cronograma. - Realización do traballo encomendado. - Redacción da memoria final sobre o traballo realizado xunto cos formularios oficiais requeridos

Planificación

	Class hours	Hours outside the classroom	Total hours
Prácticum, Practicas externas e clínicas	6	144	150

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

Metodoloxía docente

	Description
Prácticum, Practicas externas e clínicas	Realización das prácticas externas no organismo/empresa dentro do grupo de traballo e tarefa asignados

Atención personalizada

Avaliación

	Description	Qualification	Evaluated Competencess		
Prácticum, Practicas externas e clínicas	Avaliación por parte do titor da empresa durante o desenvolvemento das prácticas (informe oficial D5) Avaliación da memoria de prácticas entregada polo alumno ao finalizar a realización das mesmas. Avaliación do informe do titor académico designado polo centro. Os estudantes en prácticas deberán manter un contacto continuado non só co seu titor na empresa, senón tamén co seu titor académico. Ao concluír as prácticas, os alumnos deberán entregar ao seu titor académico unha memoria final e o informe en documento oficial D6- Informe do estudante. Na avaliación terase en conta o seguimento realizado polo titor académico e os informes entregados polo alumno.	100	CB2 CB3 CB4 CB5	CE6 CE19	CT2 CT3 CT4 CT11 CT12

Other comments on the Evaluation

Esta materia réxese polo establecido no regulamento de prácticas en empresa do centro:

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

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Recomendacións

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo *COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
Adaptarase a materia seguindo en todo momento os cambios indicados desde a reitoría da Universidade de Vigo.

Mecanismo non presencial de atención ao alumnado (titorías): Realizarase o seguimento das titorias mediante ferramentas virtuais (despacho virtual en campus remoto ou ferramentas similares) e/ou email

Modificacións (si proceden) dos contidos a impartir: En caso de crise sanitaria realizaranse de forma telemática, sempre que a empresa estea de acordo. Así mesmo, en caso de crise, unha porcentaxe do número de horas poderán completarse mediante a realización de cursos on-line relacionados coa temática da materia (por exemplo cursos organizados pola área de emprego da Universidade). Estes cursos deben contar coa aprobación previa a sua realización do titor académico das prácticas en empresa para poder ser recoñecidos como parte da materia

Bibliografía adicional para facilitar o auto-aprendizaxe: Non é necesario

=== ADAPTACIÓN DA AVALIACIÓN ===
Non hai probas adicionais. En caso de realizar cursos (aprobados polo coordinador académico das prácticas en empresa) para completar o número de horas serán valorados.

IDENTIFYING DATA				
Final Year Dissertation				
Subject	Final Year Dissertation			
Code	O07G410V01991			
Study programme	Grado en Ingeniería Aeroespacial			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Ulloa Sande, Carlos			
Lecturers	Ulloa Sande, Carlos			
E-mail	carlos.ulloa@uvigo.es			
Web	http://aero.uvigo.es			
General description	The Final Degree Project (TFG) is an original and personal work that each student will carry out independently under the tutorship of the academic staff and will allow them to demonstrate, in an integrated manner, the acquisition of the knowledge and the competences associated with the degree. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CB2	That the students know how to apply their knowledge to their work or vocation in a professional way and that they possess the competences that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study
CB3	That the students have the capability to gather and interpret relevant data (usually within their area of study) to issue judgments that include a reflection on relevant social, scientific or ethical issues
CB4	That the students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience
CB5	That the students develop those learning capabilities necessary to undertake further studies with a high degree of autonomy.
CT2	Leadership, initiative and entrepreneurship
CT3	Capability of oral and written communication in native lenguage
CT4	Capability of autonomous learning and information management
CT5	Capability to solve problems and draw decisions
CT6	Capabiliity for interpersonal communication
CT7	Capability to adapt to new situations with creativity and innovation
CT8	Capabiliity for critical and self-critical reasoning
CT9	Capability to work in interdisciplinary teams
CT10	Capability to negotiate and deal with and act in situations of conflict
CT11	Show motivation for quality with sensitivity towards subjects within the scope of the studies
CT12	Ethical and democratic commitment
CT13	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources

Learning outcomes	Competences	
Knowing, understanding, application, analysis and synthesis of a project in the field of specific engineering technologies for aerospace equipment and materials.	CB2 CB3 CB4 CB5	CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT9 CT10 CT11 CT12 CT13

Contents
Topic

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

Other comments on the Evaluation

The TFG is an original exercise that is carried out individually, is presented in front an academic tribunal. It must be a project in the field of specific technologies of Aerospace engineering, with a professional nature, in which students synthesize and integrate the competences acquired during their studies. The performance and evaluation of the TFG is regulated by 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.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The teaching methodologies are maintained except in the experimental content works that will modify their focus and their contents to adapt to the impossibility of attending the center.
* Teaching methodologies modified
Tutored work:
- Attendance to laboratories: it will be supplemented by tutorials with the tutor and / or co-tutor.
- Tutorials with tutor and / or co-tutor: alternatively, they will be held through the Remote Campus platform of the University of Vigo.
* Non-attendance mechanisms for student attention (tutoring)
The tutoring sessions will be held, alternatively, by telematic means (email or videoconference) under the modality of prior agreement.
* Modifications (if applicable) of the contents
The works of experimental content will modify their approach and their contents to adapt to the impossibility of attending the center.

=== ADAPTATION OF THE TESTS ===
* Tests that are modified
In case of no attendance, the defenses of the works will be carried out on the Remote Campus platform.