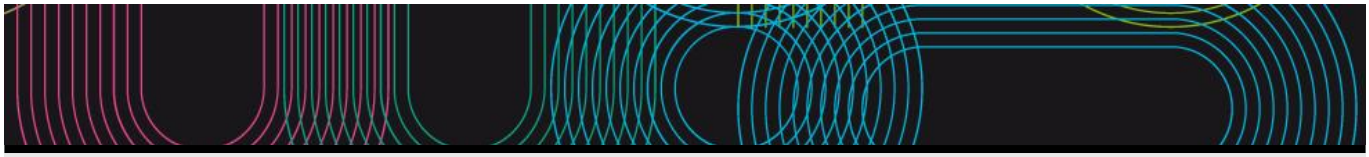

(*)Escola de Enxeñaría Industrial

Information
For additional information about the centre and its degres visit the centre's website https://eei.uvigo.es/

Grado en Ingeniería en Tecnologías Industriales

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V12G360V01101	Graphic expression: Fundamentals of engineering graphics	1st	9
V12G360V01102	Physics: Physics 1	1st	6
V12G360V01103	Mathematics: Algebra and statistics	1st	9
V12G360V01104	Mathematics: Calculus 1	1st	6
V12G360V01201	Business: Introduction to business management	2nd	6
V12G360V01202	Physics: Physics 2	2nd	6
V12G360V01203	Computer science: Computing for engineering	2nd	6
V12G360V01204	Mathematics: Calculus 2 and differential equations	2nd	6
V12G360V01205	Chemistry: Chemistry	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V12G360V01301	Materials science and technology	1st	6
V12G360V01302	Basics of circuit analysis and electrical machines	1st	6
V12G360V01303	Mechanism and machine theory	1st	6
V12G360V01304	Automation and control fundamentals	1st	6
V12G360V01305	Basics of operations management	1st	6
V12G360V01401	Electronic technology	2nd	6
V12G360V01402	Fundamentals of manufacturing systems and technologies	2nd	6

V12G360V01403	Fluid mechanics	2nd	6
V12G360V01404	Mechanics of materials	2nd	6
V12G360V01405	Thermodynamics and heat transfer	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V12G360V01501	Applied electrotechnics	1st	6
V12G360V01502	Materials engineering	1st	6
V12G360V01503	Physics 3	1st	6
V12G360V01504	Hydraulic turbomachines	1st	6
V12G360V01505	Specialized mathematics	1st	6
V12G360V01602	Machine design and testing	2nd	6
V12G360V01603	Elasticity and additional topics in mechanics of materials	2nd	6
V12G360V01604	Manufacturing engineering	2nd	6
V12G360V01605	Electrical machines	2nd	6
V12G360V01606	Chemical technology	2nd	6

Year 4th

Code	Name	Quadmester	Total Cr.
V12G360V01701	Electronic instrumentation	1st	6
V12G360V01702	Technical Office	1st	6
V12G360V01703	Environmental technology	1st	6
V12G360V01704	Thermal technology	1st	6
V12G360V01705	Electrical systems	1st	6
V12G360V01801	Control and industrial automation	2nd	6
V12G360V01802	Basics of business administration	2nd	6
V12G360V01902	Electrical components in vehicles	2nd	6
V12G360V01903	Technical english 1	2nd	6
V12G360V01904	Technical english 2	2nd	6
V12G360V01905	Methodology for the preparation, presentation and management of technical projects	2nd	6
V12G360V01906	Advanced programming for engineering	2nd	6
V12G360V01907	Safety and industrial hygiene	2nd	6
V12G360V01908	Laser technology	2nd	6
V12G360V01981	Internships: Internships in companies	2nd	6
V12G360V01991	Final Year Dissertation	2nd	12
V12G360V01999	Internships/elective	2nd	6

IDENTIFYING DATA

Graphic expression: Fundamentals of engineering graphics

Subject	Graphic expression: Fundamentals of engineering graphics			
Code	V12G360V01101			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Basic education	1st	1st
Teaching language				
Department				
Coordinator	Troncoso Saracho, José Carlos Fernández Álvarez, Antonio			
Lecturers	Alegre Fidalgo, Paulino Comesaña Campos, Alberto Corralo Domonte, Francisco Javier Fernández Álvarez, Antonio González Rodríguez, Elena Patiño Barbeito, Faustino Troncoso Saracho, José Carlos			
E-mail	antfdez@uvigo.es tsaracho@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim that pursues with this subject is to form to the student in the thematic relative to the Graphic Expression, so as to prepare for the handle and interpretation of the systems of representation more employed in the industrial reality and his basic technicians, enter him to the knowledge of the forms, generation and properties of the geometrical entities more frequent in the technician, including the acquisition of vision and space understanding, initiate him in the study of the appearances of technological character that influence in the Graphic Expression of the Engineering and enter him rationally in the knowledge and application of the Normalisation, so much in his basic appearances as in the specific. The subject will develop so that prepare to the student for the indifferent employment of traditional technicians and of new technologies of the information and communications.			

Competencies

Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG6	CG6 Capacity for handling specifications, regulations and mandatory standards.
CE5	CE5 Capacity for spatial vision and knowledge of the techniques of graphic representation, using traditional methods of metric geometry and descriptive geometry, and through the application of computer-aided design.
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Apply knowledge.

Learning outcomes

Learning outcomes	Competences		
- Know, understand, and apply a body of knowledge about the basics of drawing and standardization of industrial engineering, in its broadest sense , while promoting the development of space capacity.	CG3 CG4	CE5	CT6
Purchase the capacity for the abstract reasoning and the establishment of strategies and efficient procedures in the resolution of the graphic problems inside the context of the works and own projects of the engineering.	CG3 CG4		CT2
Use the graphic communication between technicians, by means of the realisation and interpretation of planes in accordance with the Norms of Technical Drawing, involving the use of the new technologies.	CG6	CE5	CT6 CT9
Assume a favourable attitude to the permanent learning in the profession, showing proactive, participatory and with spirit of improvement.	CG4		CT9

Contents

Topic	
Block 0. Computer-aided drawing 2D. Sketching, and application of Norms.	Introduction to the Computer-aided Drawing. Surroundings of work. Systems of Coordinates. You order of Drawing. Graphic entities. Helps to the drawing. References to entities. You order of Modification. You order of Visualisation. You order of Query. Impression and scales. 0.2. Sketching, and application of Norms
Block I 2D. Flat geometry.	I review of previous knowledges. Conical: definitions, focal and main circumferences, tangent line and normal in a point, tangent lines from an external point, own and improper. Tangencies between straight and circumferences and between circumferences (26 cases). Tools of resolution: geometrical places, operations of dilatation and investment and power. Technical curves: Trochoids: definition, traced and tangent line in a point. Other technical curves.
Block II 3D. Systems of representation.	Introduction: Types of projections. Invariants *proyectivos. System *Diédrico: Foundations. Belonging and Incidence. Parallelism and *Perpendicularidad. Distances, Angles. Operations: Twists, Changes flatly and *Abatimientos. Surfaces: Polyhedral, Irradiated and of Revolution, Surfaces: Flat Sections, Development. Intersection of Surfaces. Foundations. System of Bounded Planes: Foundations. Belonging and Incidence. Parallelism and *Perpendicularidad. Distances, Angles. *Abatimientos. Axonometric system: Foundations. Axonometric scales. Types of *axonometrias: *trimétrica, *dimétrica and isometric. System of Cavalier Perspective: Foundations. System of Conical Perspective: Foundation.

Block III. Normalisation.	Generalities on the drawing: - The drawing like language. - Types of drawings: technicians and artistic. - Technical drawings: architectural, topographical and industrial. - Industrial drawing: *Croquis, conjoint diagrams, *despieces and geometrical drawing. Normalisation of the drawing: - Advantages of the normalisation. - Difference between regulation, specification and norm. Basic normalisation: formats, writing, types of line, scales, etc. Representation normalised: - basic Principles of representation. Methods of projection - Seen. Seen particular: auxiliaries, interrupted, partial, local, turned, etc. - Courts, Sections and Breaks: Specifications, types of cut, sections (knocked down, displaced), etc. - *Rayado of courts: types of line, orientation, etc. - Conventionalisms: symmetrical pieces, repetitive elements, details, intersections, parts *contíguas, etc. *Acotación: - General principles of dimensioning. - Types of *acotación. Classification of the heights. - Principles of *acotación. - Elements of *acotación: Lines, extremes of lines, *inscriciones, etc. - Forms of *acotación: series, parallel, by coordinates, etc. - *Acotación of particular elements: radios, diameters, spheres, arches, symmetries, chamfers, etc. - Threads and threaded unions. Elements of a thread. Threaded elements. Classification of the threads. Representation of the threads. Threads normalised. - *Acotación Of threaded elements. - Designation of the threads. Drawings of group and *despiece: - Rules and agreements: reference to elements, material, numbering of planes, examples. - *Acotación Of groups. List of *despiece. Systems of tolerances and superficial finishings: - Types of tolerances: dimensional and geometrical. - Dimensional tolerances: linear and angular. - Tolerances ISO: qualities, positions, types of adjust, etc. - Systems of adjust. Examples. - Indication of superficial finishings. Representation of Elements Normalised. Diagrams.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	38	116	154
Problem solving	34	0	34
Seminars	4	0	4
Project based learning	0	27	27
Essay questions exam	2	0	2
Laboratory practice	4	0	4

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

Methodologies	
	Description
Lecturing	Active master Session. Each thematic unit will be presented by the professor, complemented with the comments of the students with base in the bibliography assigned or another pertinent.

Problem solving	They will pose exercises and/or problems that will resolve of individual way or *grupal.
Seminars	Realisation of activities of reinforcement to the learning by means of the resolution *tutelada of way *grupal of practical suppositions linked to the theoretical contents of the subject.
Project based learning	Realisation of activities that require the active participation and the collaboration between the students.

Personalized assistance

Methodologies	Description
Seminars	

Assessment

	Description	Qualification	Evaluated Competencess		
Essay questions exam	It will realise a final examination that will cover the whole of the contents of the subject, so many theorists like practical, and that they will be able to include test type test, questions of reasoning, resolution of problems and development of practical cases. It demands reach a minimum qualification of 4,0 points on 10 possible to be able to surpass the subject.	65	CG3 CG4	CE5	CT2 CT9
Laboratory practice	Along the triannual, in determinate sessions of resolution of problems and exercises will pose problems or exercises for his resolution by the students and back delivery to the professor, that will evaluate them in accordance with the criteria that previously will have communicated to the students.	35	CG4	CE5	CT2 CT6 CT9

Other comments on the Evaluation

In second announcement will realise to the student a theoretical proof-practical to evaluate his degree of acquisition of competitions, of analogous characteristics to the final examination, in which to surpass the *asignatura will be necessary to reach a minimum qualification of 5,0 points on 10 possible.

Ethical commitment: It is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

Responsible professors of groups:

Group To: Javier *Corralo *Domonte.

Group *B: Carlos *Troncoso *Saracho.

Group C: Antonio Fernández Álvarez.

Group D: Carlos *Troncoso *Saracho.

Group G: Ernesto *Roa Farmyard.

Group *H: Esteban López *Figueroa.

Group I: Faustino *Patiño *Barbeito.

Group *J: Ernesto *Roa Farmyard.

Group *K: Manuel Adán Gómez.

Group L: Faustino *Patiño *Barbeito.

Sources of information

Basic Bibliography

Corbella Barros, David, **Trazados de Dibujo Geométrico 1**, Madrid 1970,

Ladero Lorente, Ricardo, **Teoría do Debuxo Técnico**, Vigo 2012,

Asociación Española de Normalización (AENOR), **Normas UNE de Dibujo Técnico**, Versión en vigor,

Félez, Jesús; Martínez, Mª Luisa, **DIBUJO INDUSTRIAL**, 3ª Edición, ISBN: 84-7738-331-6,

Casasola Fernández, Mª Isabel y otros, **Sistemas de representación I, Teoría y problemas**, ISBN 978-84-615-3553-8, Ed. Asociación de Investigación, 2011

Complementary Bibliography

López Poza, Ramón y otros, **Sistemas de Representacion I**, ISBN 84-400-2331--6,

Izquierdo Asensi, Fernando, **Geometría Descriptiva**, 24ª Edición. ISBN 84-922109-5-8,

Auria, José M.; Ibáñez Carabantes, Pedro; Ubieto Artur, Pedro, **DIBUJO INDUSTRIAL. CONJUNTOS Y DESPIECES**, 2ª Edición, ISBN: 84-9732-390-4,
Guirado Fernández, Juan José, **INICIACIÓN Á EXPRESIÓN GRÁFICA NA ENXEÑERÍA**, ISBN: 84-95046-27-X,
Ramos Barbero, Basilio; García Maté, Esteban, **DIBUJO TÉCNICO**, 2ª Edición, ISBN: 84-8143-261-X,
Manuales de usuario y tutoriales del software DAO empleado en la asignatura,
Giesecke, Mitchell, Spencer, Hill, Dygdon, Novak, Lockhart, **Technical Drawing with Engineering Graphics,**, 14ª, Prentice Hall, 2012
David A. Madsen, David P. Madsen, **Engineering Drawing & Design**, 5ª, Delmar Cengage Learning, 2012

Recommendations

Other comments

It is recommended for a suitable follow-up of the subject have of previous knowledges of drawing, to the level of the studies *cursados in the *Bachillerato of the Scientific Option-Technological.

In case of discrepancies between versions shall prevail spanish version of this guide.

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				
Physics: Physics 1				
Subject	Physics: Physics 1			
Code	V12G360V01102			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Lusquiños Rodríguez, Fernando			
Lecturers	Añel Cabanelas, Juan Antonio Blanco García, Jesús Boutinguiza Larosi, Mohamed Cabaleiro Álvarez, David Iglesias Prado, José Ignacio Legido Soto, José Luís Lusquiños Rodríguez, Fernando Méndez Morales, Trinidad Ribas Pérez, Fernando Agustín Sánchez Vázquez, Pablo Breogán Serra Rodríguez, Julia Asunción Soto Costas, Ramón Francisco Trillo Yáñez, María Cristina			
E-mail	flusqui@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Física do primeiro curso das Enxeñarías da rama Industrial			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
(*)FB2a. Comprensión y dominio de los conceptos básicos sobre las leyes generales de la mecánica y campos y ondas y su aplicación para la resolución de problemas propios de la ingeniería.	CG3	CE2	
(*)CG3. Conocimiento en materias básicas y tecnológicas, que les capacite para el aprendizaje de nuevos métodos y teorías, y les dote de versatilidad para adaptarse a nuevas situaciones.		CE2	
(*)CS2. Aprendizaje y trabajo autónomos.	CG3	CE2	CT9 CT10
New	CG3	CE2	CT2 CT9 CT10

Contents
Topic

1.- UNITS, PHYSICAL AMOUNTS AND VECTORS	1.1.- The nature of Physics. 1.2.- Consistency and conversions of units. 1.3.- Uncertainty and significant figures. 1.4.- Estimates and orders of magnitude. 1.5.- Vectors and sum of vectors. 1.6.- Vector components. 1.7.- Unitary vectors. 1.8.- Vector products. 1.9.- Sliding Vectors
2.- CINEMATIC OF THE POINT	2.1.- Vectors of position, speed and acceleration. Half and instantaneous values 2.2.- Vectors angular speed and angular acceleration. Half and instantaneous values. 2.3.- Relation between linear cinematic magnitudes and angular 2.4.- Intrinsic components. 2.5.- Study of simple movements: *mov. Rectilinear, *mov. Circulate, shot *oblicuo 2.6.- Expressions of cinematic magnitudes in coordinates *cartesianas and polar
3.- LAWS OF THE MOVEMENT OF NEWTON	3.1.- Strength and interactions. 3.2.- First law of Newton. Systems of inertial and non inertial references 3.3.- Second law of Newton. 3.4.- Mass and weight. 3.5.- Third law of Newton. 3.6.- Quantity of movement. Mechanical impulse. Angular moment. 3.7.- Strengths of contact: active, of *ligadura.
4.- WORK AND KINETIC ENERGY	4.1.- Work realized by a Force. Power. 4.2.- Kinetic Energy. 4.3.- Conservative Forces 4.4.- Elastic potential energy. 4.5.- Potential energy in the gravitatory field. 4.6.- Mechanical energy. 4.7.- Strength and potential energy. 4.8.- Principle of conservation of the mechanical energy.
5.- KINEMATICS OF SYSTEM OF POINTS	5.1.- Points system. 5.2.- Rigid solid. 5.3.- Translation movement. 5.4.- Movement of rotation around a fixed axis. 5.5.- General movement. 5.6.- Instant center of rotation. 5.7.- Rolling motion. 5.8.- Relative movement.
6.- DYNAMICS OF THE SYSTEMS OF PARTICLES	6.1.- Systems of particles. Inner and exterior strengths. 6.2.- Center of masses of the system. Movement of the c.o.m. 6.3.- Equations of the movement of a system of particles. 6.4.- Linear moment. Theorem Of conservation. 6.5.- Angular moment of a system of particles. Theorem Of conservation. 6.6.- Work and power. 6.7.- Potential energy and kinetics of a system of particles. 6.8.- Theorem Of the energy of a system of particles. 6.9.- Crashes.
7.- DYNAMICS OF THE RIGID SOLID	7.1.- Rotation of a rigid solid around a fixed axis. 7.2.- Moments and products of inertia. 7.3.- Calculation of moments of inertia. 7.4.- Steiner's theorem. 7.5.- Moment of a force and pair of forces. 7.6.- Equations of the general movement of the rigid solid. 7.7.- Kinetic energy in the general movement of the rigid solid. 7.8.-Work in the general movement of the rigid solid. 7.9.- Angular moment of a rigid solid. Conservation theorem.
8.- STATIC	8.1.- Balance of rigid solids. 8.2.- Center of gravity. 8.3.- Stability. 8.4.- Degrees of freedom and ligatures

9.- PERIODIC MOVEMENT	9.1.- Description of the oscillation. 9.2.- Simple harmonic movement. 9.3.- Energy in the simple harmonic movement. 9.4.- Applications of simple harmonic movement. 9.5.- The simple pendulum. 9.6.- The physical pendulum. 9.7.- Damped oscillations. 9.8.- Forced oscillations and resonance.
10.- FLUID MECHANICS	10.1.- Density. 10.2.- Pressure in a fluid. 10.3.- Fundamental principles of Fluidostática. 10.4.- Continuity equation. 10.5.- Bernoulli equation.
11.- MECHANICAL WAVES	11.1.- Types of mechanical waves. 11.2.- Periodic waves. 11.3.- Mathematical description of a wave. 11.4.- Speed of a transverse wave. 11.5.- Energy of the wave movement. 11.6.- Wave interference, boundary conditions and superposition. 11.7.- Stationary waves on a string. 11.8.- Normal modes of a rope.
LABORATORY	1.- Theory of Measurements, Errors, Graphs and Adjustments. Examples 2.- Reaction Time. 3.- Determination of the density of a body. 4.- Relative Movement. 5.- Instantaneous speed. 6.- Study of the Simple Pendulum. 7.- Experiences with a helical spring. 8.- Damped and forced oscillations. 9.- Moments of inertia. Determination of the radius of rotation of a body. 10.- Stationary waves.
LABORATORY NO STRUCTURED	1. Sessions with activities no structured (open practice) that range the theoretical contents of the practices enumerated up. The groups of students have to resolve a practical problem proposed by the professor, selecting the theoretical frame and experimental tools to obtain the solution; for this, dispondrán of basic information and guide of the professor

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24.5	45	69.5
Problem solving	8	20	28
Laboratory practical	18	18	36
Objective questions exam	1	0	1
Problem and/or exercise solving	3.5	0	3.5
Essay questions exam	3	0	3
Report of practices, practicum and external practices	0	9	9

*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 part of the professor of the contents on the subject object of study, theoretical bases and/or guidelines of a work, exercise or project to develop by the student.
Problem solving	Activity in which formulate problem and/or exercises related with the asignatura. The student has to develop the felicitous or correct solutions by means of the ejercitación of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results. suele Use as I complement of the lesson magistral.
Laboratory practical	Activities of application of the knowledges to concrete situations and of acquisition of basic skills and procedimentales related with the subject object of study. They develop in special spaces with equipment especializado (laboratories, classrooms informáticas, etc).

Personalized assistance

Methodologies	Description
Lecturing	In office hours

Laboratory practical	in office hours
Problem solving	In office hours
Tests	**Description**
Objective questions exam	In office hours
Problem and/or exercise solving	In office hours
Essay questions exam	In office hours
Report of practices, practicum and external practices	In office hours

Assessment

	Description	Qualification	Evaluated Competencess		
Objective questions exam	Tests for evaluating the acquired competences that include closed questions with different answer alternatives (true / false, multiple choice, pairing of elements ...). Students select an answer from a limited number of possibilities.	10	CG3	CE2	
Problem and/or exercise solving	Test in which the student must solve a series of problems and / or exercises in a time / condition established by the teacher. In this way, the student must apply the knowledge they have acquired.	40	CG3	CE2	CT2
Essay questions exam	Competency assessment tests that include open-ended questions on a topic. Students must develop, relate, organize and present the knowledge they have on the subject in an extensive answer.	40	CG3	CE2	
Report of practices, practicum and external practices	Preparation of a document by the student that reflects the characteristics of the work carried out. Students must describe the tasks and procedures developed, show the results obtained or observations made, as well as the analysis and treatment of data.	10	CG3	CE2	CT9 CT10

Other comments on the Evaluation

The qualification of the continuous evaluation (which we will call EC) will have a weight of 40% of the final grade and will include both the contents of the laboratory practices (weight of 20%, which we will call ECL qualification) and of the classroom (weight of 20% , which we will call ECA qualification).

The ECA qualification will be obtained through theoretical-practical tests (they will be able to understand objective questions and / or development questions) on classroom content.

The ECL qualification will be obtained as the sum of the qualification of the Reports / memories of practices on laboratory contents.

Those students who can not follow the continuous assessment and who have been granted the rejection of the continuous assessment will have the possibility of taking a final written test to obtain a REC grade that will weigh 40% of the final grade and will include both the contents of the laboratory practices (weight of 20%, which we will call RECL rating) as classroom (weight of 20%, which we will call RECA rating).

The remaining 60% of the final grade will be obtained by completing a final exam that will consist of two parts: a theoretical part (which we will call T) that will weigh 20% of the final grade and another part of problem solving (which we will call P) that will have a weight of 40% of the final grade. The theoretical part will consist of a theoretical-practical test (objective questions and / or development questions). Those students who do not appear for the final exam will obtain a grade of not presented.

Both the final exams and those that are held on dates and / or times different from those officially set by the center, may have an exam format different from the one previously described, although the parts of the exam retain the same value in the final grade.

Final grade G of the subject for the continuous assessment modality:

G = ECL + ECA + T + P

Final grade G of the subject for the evaluation modality at the end of the semester and July (the RECL and RECA options only for students with waiver granted):

G = ECL (or RECL) + ECA (or RECA) + T + P.

To pass the subject, it is a necessary and sufficient condition to have obtained a final grade G greater than or equal to 5.

Ethical commitment: The student is expected to exhibit adequate ethical behavior. In the case of detecting unethical behavior (copying, plagiarism, unauthorized use of electronic devices, etc.), the student will be considered not to meet the necessary requirements to pass the subject. In this case, the overall grade in the current academic year will be suspended (0.0).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The fact of introducing an electronic device not authorized in the exam room will be considered a reason for not passing the subject in this academic year and the overall rating will be suspended (0,0).

Sources of information

Basic Bibliography

1. Young H.D., Freedman R.A., **Física Universitaria, V1**, 13ª Ed., Pearson,

Complementary Bibliography

2. Tipler P., Mosca G., **Física para la ciencia y la tecnología, V1**, 5ª Ed., Reverté,
3. Serway R. A., **Física para ciencias e ingeniería, V1**, 7ª Ed., Thomson,
4. Juana Sardón, José María de, **Física general, V1**, 2ª Ed., Pearson Prentice-Hall,
5. Bronshtein, I. Semendiaev, K., **Handbook of Mathematics**, 5ª Ed., Springer Berlín,
6. Jou Mirabent, D., Pérez García, C., Llebot Rabagliati, J.E., **Física para ciencias de la vida**, 2ª Ed., McGraw Hill Interamericana de España S.L.,
7. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos**, 1ª Ed, ECU,
8. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos, Volumen II**, 1ª Ed, ECU,
9. Villar Lázaro R., López Martínez, C., Cussó Pérez, F., **Fundamentos Físicos de los Procesos Biológicos, Volumen III**, 1ª Ed, ECU,
10en. Villars, F., Benedek, G.b., **Physics with Illustrative Examples from Medicine and Biology**, 2ª Ed., AIP Press/Springer-Verlag,

Recommendations

Other comments

Recommendations:
1. Basic knowledge acquired in the subjects of Physics and Mathematics in previous courses.
2. Capacity for written and oral comprehension.
3. Abstraction capacity, basic calculation and synthesis of information.
4. Skills for group work and group communication.

In case of discrepancy between versions, the Spanish version of this guide will 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

* Teaching methodologies modified

All methodologies (master class, problem solving and laboratory practices): in the mixed modality, the teaching activity will be carried out combining face-to-face and non-face-to-face teaching using Remote Campus, also using the FAITIC teleteaching platform as reinforcement. In the non-classroom modality, the teaching activity will be carried out through the Remote Campus, also using the FAITIC teleteaching platform as reinforcement. All this without prejudice to being able to use complementary measures that guarantee the accessibility of the students to the educational contents.
Laboratory practices. In the mixed modality, the experimental activities using lab equipment and data collection by the

students will suffer limitations and will be largely replaced by demonstrations in the laboratory carried out by teaching staff, which will be witnessed by the students present in the laboratory and accessible to the rest of the students by telematic means. The data processing activities do not require the use of equipment and can be carried out outside the laboratory (in a classroom, at home, etc.) and may be carried out by both the students present in the laboratory and by those who follow the class electronically. In the non-face-to-face modality, the classes will be maintained, but they will be developed entirely by telematic means. The activities of equipment management and data collection by the students will be totally replaced by demonstrations carried out by teaching staff and / or specific audiovisual material.

* Non-attendance mechanisms for student attention (tutoring)
The tutorials may be carried out either in person (as long as it is possible to guarantee sanitary guidelines) or telematically, either asynchronously (email, FAITIC forums, etc.) or by videoconference, in this case by appointment.

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
...

* Pending tests that are maintained
Final exam, part P 40%, maintains weight
Final exam, part T 20%, maintains weight

* Tests that are modified
ECA 20%, types of tests: comprises an exam of objective questions, exam of development questions => ECA 20%, types of tests: comprises an exam of objective questions, exam of development questions, problem solving and / or exercises .
ECL 20%, types of tests: comprises examination of development questions, practice report 10% => ECL, weight 20%, types of tests: comprises exam of development questions, problem solving and / or exercises, report of practices 10%.

* New tests

* Additional Information

IDENTIFYING DATA				
Mathematics: Algebra and statistics				
Subject	Mathematics: Algebra and statistics			
Code	V12G360V01103			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Luaces Pazos, Ricardo			
Lecturers	Bazarra García, Noelia Castejón Lafuente, Alberto Elias Fiestras Janeiro, Gloria Godoy Malvar, Eduardo Gómez Rúa, María Luaces Pazos, Ricardo Martín Méndez, Alberto Lucio Martínez Torres, Javier Matías Fernández, José María Meniño Cotón, Carlos Rodal Vila, Jaime Alberto Rodríguez Campos, María Celia Sestelo Pérez, Marta			
E-mail	rluaces@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of this course is to provide the student with the basic techniques in Algebra and Statistics that will be necessary in other courses of 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	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE1	CE1 Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.
CT2	CT2 Problems resolution.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Apply knowledge.

Learning outcomes			
Learning outcomes	Competences		
Acquire the basic knowledge on matrices, vector spaces and linear maps.	CG3	CE1	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	CG3	CE1	CT2
Understand the basic concepts on eigenvalues and eigenvectors, vector spaces with scalar product and quadratic forms used in other courses and sove basic problems related to these subjects.	CG3	CE1	CT2 CT9
Perform basic exploratory analysis of databases.	CG3	CE1	CT5
Model situations under uncertainty by means of probability.	CG3	CE1	CT2
Know basic statistical models and their application to industry and perform inferences from data samples.	CG3	CE1	CT2 CT9
Use computer tools to solve problems of the contents of the course.	CG3		CT2 CT6

Contents

Topic	
Preliminaries	The field of complex numbers.
Matrices, determinants and systems of linear equations.	Definition and types of matrices. Matrices operations. Elementary transformations, row echelon forms, rank of a matrix. Inverse and determinant of a square matrix. Consistency of systems of linear equations and their solutions.
Vector spaces and linear maps.	Vector space. Subspaces. Linear independence, basis and dimension. Coordinates, change of basis. Basic notions on linear maps.
Eigenvalues and eigenvectors.	Definition of eigenvalue and eigenvector of a square matrix. Diagonalization of matrices by similarity transformation. Applications of eigenvalues and eigenvectors.
Vector spaces with scalar product and quadratic forms.	Vectorial spaces with scalar product. Associated norm and properties. Orthogonality. Gram-Schmidt orthonormalization process. Orthogonal diagonalization of a real and symmetric matrix. Quadratic forms.
Probability.	Concept and properties. Conditional probability and independence of events. Bayes Theorem.
Discrete random variables and continuous random variables.	Definition of random variable. Types of random variables. Distribution function. Discrete random variables. Continuous random variables. Characteristics of a random variable. Main distributions: Binomial, Geometric, Poisson, Hypergeometric, Uniform, Exponential, Normal. Central Limit Theorem.
Statistical inference.	General concepts. Sampling distributions. Point estimation. Confidence intervals. Tests of hypotheses.
Regression.	Scatterplot. Correlation. Linear regression: regression line. Inference about the parameters of the regression line.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	40	81	121
Problem solving	12	12	24
Laboratory practical	24	12	36
Autonomous problem solving	0	40	40
Essay questions exam	4	0	4

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

Methodologies

	Description
Lecturing	The lecturer will explain the contents of the course.
Problem solving	Problems and exercises will be solved during the classes. Students will also solve similar problems and exercises.
Laboratory practical	Computer tools will be used to solve problems related to the contents of the course.
Autonomous problem solving	Student will have to solve problems and exercises by their own.

Personalized assistance

Methodologies	Description
Laboratory practical	
Lecturing	
Problem solving	
Autonomous problem solving	

Assessment

	Description	Qualification	Evaluated Competencess		
Problem solving	Students will make several mid-term exams of Algebra and Statistics during the course.	40 por cento en Álxebra; 20 por cento en Estatística	CG3	CE1	CT2 CT5 CT6 CT9
Essay questions exam	At the end of the semestre there will a final exam of Algebra and a final exam of Statistics.	60 por cento en Álxebra; 80 por cento en Estatística	CG3	CE1	CT2 CT5 CT6 CT9

Other comments on the Evaluation

At the end of the first quarter, once the mid-term exams and the final exams have been done, the student will have a grade out of 10 points in Algebra (A) and a grade out of 10 points in Statistics (S). The final qualification of the subject will be calculated as follows:

- If both grades, A and S, are greater or equal to 3.5, then the final grade will be (A+S)/2.

- Any of the grades A or S is less than 3.5, then the final qualification will be the minimum of the quantities (A+S)/2 and 4.5.

The students who are exempted by the School from taking the mid-term exams will be evaluated through a final exam of Algebra (100% of the grade of this part) and a final exam of Statistics (100% of the grade of this part). The final grade will be calculated according to procedure described above.

A student will be assigned to NP ("absent") if he/she is absent in both final exams (i.e. Algebra and Statistics); otherwise he/she will be graded according the the procedure described above.

The assessment in the second call (June/July) will be done by means of a final exam of Algebra and a final exam of Statistics (100% of the grade of each part). The final grade will be calculated according to procedure described above.

If at the end of the first quarter a student obtains a grade equal to or greater than 5 out of 10 in any of the parts of the subject (Algebra or Statistics) then he/she will keep this grade in the second call (June/July) without retaking the corresponding exam.

Ethical commitment: Students are expected to commit themselves to an adequate and ethical behaviour. Students showing unethical behaviours (exam cheating, plagiarism, unauthorized use of electronic devices, etc.) will be rated with the minimum grade (0.0) in the current academic year.

As a general rule, the use of any electronic device for the assessment tests is not allowed unless explicitly authorized.

Sources of information

Basic Bibliography

Lay, David C., **Álgebra lineal y sus aplicaciones**, 4ª,
Nakos, George; Joyner, David, **Álgebra lineal con aplicaciones**, 1ª,
de la Villa, A., **Problemas de álgebra**, 4ª,
Cao, Ricardo et al., **Introducción a la Estadística y sus aplicaciones**, 1ª,
Devore, Jay L., **Probabilidad y estadística para ingeniería y ciencias.**, 8ª,
Devore, Jay L., **Probability and statistics for engineering and sciences**, 8ª,

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus I/V12G380V01104

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 ===

ALGEBRA
=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
The teaching will follow its planning, but it will be carried out using UVIGO`s technological platform.
* Non-attendance mechanisms for student attention (tutoring)
The tutorials will be carried out through the Remote Campus by appointment
=== ADAPTATION OF THE EVALUATION ===
The evaluation will follow its planning, but will be carried out using UVIGO`s technological platform.

STATISTICS:
=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
Theoretical and practical teaching will be carried out telematically using the UVigo technological platfom.
* Non-attendance mechanisms for student attention (tutoring)
The tutorials will be carried out through the Remote Campus by appointment
=== ADAPTATION OF THE TESTS ===
* Tests already carried out
The weight of the mid-term exam will be maintained (20%).
* Pending tests that are maintained
The mid-term exam (20%) will be maintained if it had not been done in-person. This exam will be carried out using UVigo's technological platform.
First semester exam: The exam will be a multiple-choice test (80%).
Final exam: The exam will be a multiple-choice test (100%).

IDENTIFYING DATA				
Matemáticas: Cálculo I				
Subject	Matemáticas: Cálculo I			
Code	V12G360V01104			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Castelán Galego			
Department	Matemática aplicada I Matemática aplicada II			
Coordinator	Martínez Martínez, Antonio			
Lecturers	Díaz de Bustamante, Jaime Martínez Martínez, Antonio Martínez Torres, Javier Meniño Cotón, Carlos Prieto Gómez, Cristina Magdalena Rodal Vila, Jaime Alberto Vidal Vázquez, Ricardo			
E-mail	antonmar@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	O obxectivo desta materia é que o estudante adquira o dominio das técnicas básicas de cálculo diferencial nunha e en varias variables e de cálculo integral nunha variable que son necesarias para outras materias que debe cursar na titulación.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE1	CE1 Capacidade para a resolución dos problemas matemáticos que poidan presentarse 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	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.
CT14	CT14 Creatividade.
CT16	CT16 Razoamento crítico.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Comprensión dos coñecementos básicos de cálculo diferencial dunha e de varias variables.	CG3	CE1	CT1
Comprensión dos coñecementos básicos de cálculo integral de funcións dunha variable.	CG3	CE1	CT1
Manexo das técnicas de cálculo diferencial para a localización de extremos, a aproximación local de funcións e a resolución numérica de sistemas de ecuacións.	CG3 CG4	CE1	CT2 CT9 CT14 CT16
Manexo das técnicas de cálculo integral para o cálculo de áreas, volumes e superficies.	CG3 CG4	CE1	CT1 CT2 CT9 CT14 CT16
Utilización de ferramentas informáticas para resolver problemas de cálculo diferencial e de cálculo integral.	CG4	CE1	CT2 CT6 CT9 CT16

Contidos
Topic

Converxencia e continuidade	Introdución aos números reais. Valor absoluto. O espazo euclídeo R^n. Sucesións. Series. Límites e continuidade de funcións dunha e de varias variables.
Cálculo diferencial de funcións dunha e de varias variables	Cálculo diferencial de funcións dunha variable real. Cálculo diferencial de funcións de varias variables reais.
Cálculo integral de funcións dunha variable	A integral de Riemann. Cálculo de primitivas. Integrais impropias. Aplicacións da integral.

Planificación

	Class hours	Hours outside the classroom	Total hours
Resolución de problemas	20.5	30	50.5
Prácticas de laboratorio	12.5	5	17.5
Lección maxistral	32	39	71
Resolución de problemas e/ou exercicios	3	3	6
Exame de preguntas de desenvolvemento	2	3	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
Resolución de problemas	O profesor resolverá problemas e exercicios tipo e o alumno terá que resolver exercicios similares.
Prácticas de laboratorio	Empregaranse ferramentas informáticas para resolver exercicios e aplicar os coñecementos obtidos nas clases de teoría.
Lección maxistral	O profesor exporá nas clases teóricas os contidos dá a materia.

Atención personalizada

Methodologies	Description
Resolución de problemas	O profesor atenderá persoalmente as dúbidas e consultas do alumnado.
Prácticas de laboratorio	O profesor atenderá persoalmente as dúbidas e consultas do alumnado.

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas e/ou exercicios	Realizaranse probas escritas e/ou traballos.	40	CG3 CG4	CE1	CT1 CT2 CT6 CT9 CT14 CT16
Exame de preguntas de desenvolvemento	Farase un exame final sobre os contidos da totalidade da materia.	60	CG3 CG4	CE1	CT1 CT2 CT9

Other comments on the Evaluation

A avaliación continua levaráse a cabo sobre os criterios anteriormente expostos. Aqueles alumnos que non se acollan á avaliación continua serán avaliados cun exame final sobre os contidos da totalidade da materia, que suporá o 100% da nota.

A avaliación dos alumnos en segunda convocatoria consistirá nun exame sobre os contidos da totalidade da materia, que suporá o 100% da nota.

Compromiso ético:

"Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0.0)."

Bibliografía. Fontes de información

Basic Bibliography

Burgos, J., **Cálculo Infinitesimal de una variable**, 2ª, McGraw-Hill, 2007

Burgos, J., **Cálculo Infinitesimal de varias variables**, 2ª, McGraw-Hill, 2008
Galindo Soto, F. y otros, **Guía práctica de Cálculo Infinitesimal en una variable**, 1ª, Thomson, 2003
Galindo Soto, F. y otros, **Guía práctica de Cálculo Infinitesimal en varias variables**, 1ª, Thomson, 2005
Larson, R. y otros, **Cálculo 1**, 9ª, McGraw-Hill, 2010
Larson, R. y otros, **Cálculo 2**, 9ª, McGraw-Hill, 2010
Stewart, J., **Cálculo de una variable. Trascendentes tempranas**, 7ª, Thomson Learning, 2014

Complementary Bibliography

García, A. y otros, **Cálculo I**, 3ª, CLAGSA, 2007
García, A. y otros, **Cálculo II**, 2ª, CLAGSA, 2006
Rogawski, J., **Cálculo. Una variable**, 2ª, Reverte, 2012
Rogawski, J., **Cálculo. Varias variables**, 2ª, Reverte, 2012
Tomeo Perucha, V. y otros, **Cálculo en una variable**, 1ª, Garceta, 2011
Tomeo Perucha, V. y otros, **Cálculo en varias variables**, 1ª, Garceta, 2011

Recomendacións

Subjects that continue the syllabus

Matemáticas: Cálculo II e ecuacións diferenciais/V12G330V01204

Subjects that are recommended to be taken simultaneously

Matemáticas: Álxebra e estatística/V12G330V01103

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 DE LAS METODOLOGÍAS Y EVALUACIÓN ===

Si la situación sanitaria lo requiere,

- La actividad docente se realizará a través de Campus Remoto, utilizando también la plataforma de teledocencia FAITIC como refuerzo, todo ello sin perjuicio de poder utilizar medidas complementarias que garanticen la accesibilidad de los estudiantes a los contenidos docentes.

- Las sesiones de tutorización se podrán llevar a cabo mediante medios telemáticos.

- La evaluación se realizará utilizando medios telemáticos. Durante el periodo de corrección de los exámenes por parte del profesorado, el estudiante podrá ser convocado telefónica o telemáticamente por su profesor para aclarar aspectos de sus respuestas. La ausencia de explicaciones convincentes tendrá repercusión en la calificación.

IDENTIFYING DATA				
Business: Introduction to business management				
Subject	Business: Introduction to business management			
Code	V12G360V01201			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Álvarez Llorente, Gema			
Lecturers	Álvarez Llorente, Gema Arevalo Tomé, Raquel Fernández Arias, María Jesús González-Portela Garrido, Alicia Trinidad Pérez Pereira, Santos Sinde Cantorna, Ana Isabel Urgal González, Begoña			
E-mail	galvarez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Esta materia ten como obxectivo fundamental ofrecer ao alumno unha visión preliminar ou introdutoria, de carácter teórico-práctico, encol a natureza e o funcionamento das organizacións empresariais e a súa relación coa contorna na que operan, así como as actividades que levan a cabo. Para iso, entre outras cousas, definiremos o termo empresa dende un punto de vista multidimensional que abrangue a complexidade do seu funcionamento como sistema aberto. Posteriormente, analizaremos as relacións da empresa coa súa contorna, e entraremos no estudo das súas principais áreas funcionais que contribúen ao correcto desenvolvemento da súa actividade.			

Competencies	
Code	
CG9	CG9 Ability to organize and plan within the sphere of a company, and other institutions and organizations.
CE6	CE6 Adequate knowledge of the concept of enterprise and institutional and legal framework of enterprises. Organization and Business Management.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT7	CT7 Ability to organize and plan.
CT18	CT18 Working in an international context.

Learning outcomes			
Learning outcomes		Competences	
Know the role of the company in the field of economic activity.		CE6	CT18
Understand the basic aspects that characterize the different types of companies.		CE6	CT1 CT18
Know the legal framework of the different types of companies.		CE6	CT1
Know the most relevant aspects of the organization and management in the company.	CG9	CE6	CT1 CT18
Acquire skills on the processes that affect business management.	CG9	CE6	CT2 CT7 CT18

Contents	
Topic	
1. THE COMPANY	1.1 The nature of the firm 1.2 The role of the company in the socio-economic system. 1.3 The company as a system. 1.4 The environment of the company. 1.5 Company objectives and goals. 1.6 Types of companies.

2. FINANCIAL MANAGEMENT (PART I). ECONOMIC AND FINANCIAL STRUCTURE OF THE COMPANY	2.1 Economic and financial structure of the company. 2.2 Working Capital 2.3 Operating cycle and Cash Conversion Cycle 2.4 Working Capital requirement
3. FINANCIAL MANAGEMENT (PART II). UNDERSTANDING THE RESULTS OF THE COMPANY	3.1 The results of the company. 3.2 The profitability of the company. 3.3 The competitive strategy.
4. FINANCIAL MANAGEMENT (PART III). INVESTMENT DECISIONS.	4.1 Definition of Investment. 4.2 Types of investments. 4.3. Investment Appraisal Techniques
5: The FINANCIAL SYSTEM (PART IV). FINANCE	5.1 Concept of source of finance. 5.2 Types of sources of finance. 5.3 Analyses of the solvency and liquidity of the company
6. OPERATION MANAGEMENT (PART I). GENERAL FEATURES	6.1 Production system. 6.2 Efficiency. 6.3 Productivity 6.4 Research, development and innovation (R&D&I).
7: The SYSTEM OF PRODUCTION (PART II). The COSTS OF PRODUCTION	7.1 Concept of cost. 7.2 Classification of the costs. 7.3 The cost of production. 7.4 The margins of the company. 7.5 Threshold of profitability. 7.6 Capacity of production and location. 7.7 Management of inventories
8. MARKETING MANAGEMENT	8.1 What is marketing? 8.2 Basic concepts. 8.3 Marketing tools: Marketing mix.
9. MANAGEMENT AND ORGANIZATION	9.1 Components of the organization and management system. 9.2 The management system. 9.3 The human system. 9.4 The cultural system. 9.5 The political system.
PRACTICES OF THE MATTER *The programming of the practical can experience changes in function of the evolution of the course.	Practice 1: Application of concepts of the subject 1. Practice 2: Application of concepts of the subject 1. Practice 3: Application of concepts of the subject 2. Practice 4: Application of concepts of the subject 2. Practice 5: Application of concepts of the subject 2. Practice 6: Application of concepts of the subject 3. Practice 7: Application of concepts of the subject 4. Practice 8: Application of concepts of the subject 5. Practice 9: Application of concepts of the subject 6. Practice 10: Application of concepts of the subject 7. Practice 11: Application of concepts of the subject 8. Practice 12: Application of concepts of the subject 9.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	45.5	78
Laboratory practical	18	45	63
Objective questions exam	3	6	9

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

Methodologies	
	Description
Lecturing	Explanation of the main contents of the course.
Laboratory practical	Application to specific problems of the knowledge acquired in theoretical classes.

Personalized assistance	
Tests	**Description**

Objective questions exam	The students will have occasion of acudir to tutorías in the dispatch of the professor in the time that the professors will establish to such effect to principle of course and that will publish in the platform of teledocencia Faitic. These tutorías are destinadas to resolve doubts and orientar to the students on the development of the contents abordados in the theoretical kinds, the practical kinds and the works that can them encomendar. In this apartado also includes the aclaración to the students of any question on the proofs realized along the course.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	In accordance with the planning docente of the academic course, the student will have to develop a number determined of practices that include diverse exercises of application of the knowledges purchased in the kinds of theory to concrete situations and allow to develop diverse basic skills (capacity for the resolution of problems, initiative, work in team, etc.). These practices do not take part in the calculation of the qualification of the subject, but exige to the student obtain an exert minimum in the same for the superación of the subject.	0	CG9	CE6	CT1 CT2 CT7 CT18
Objective questions exam	Will realize , and minimum, two test type test along the course, in which will evaluate the knowledges, the destrezas and the competitions purchased by the students so much in the classrooms of theory and of practices.	100	CG9	CE6	CT1 CT2

Other comments on the Evaluation

1. Ethical commitment:

The student is expected to exhibit adequate ethical behavior. In the case of detecting unethical behavior (copy, plagiarism, use of unauthorized electronic devices, for example) it will be considered that the student does not meet the necessary requirements to pass the subject. In that case, the overall grade in the current academic year will be suspended

(0.0).

2. Continuous evaluation system

Following the guidelines of the degree and the agreements of the academic commission will offer students / s who study this subject a continuous assessment system.

The continuous evaluation will consist of two test type tests that will be carried out throughout the course. Each one of the test type tests will deal with the contents seen until the moment of its realization, both in theory and practical classes. Therefore, the first test will not release material for the performance of the second test. Due to this, each of these tests will have a different weight in the calculation of the grade obtained in the subject. The first 30% and the second 70%.

These tests are not recoverable, that is, if a student can not perform them on the stipulated date, the teacher does not have to repeat them, unless justified and duly accredited by the student.

The student has the right to know the grade obtained in each test within a reasonable time after its completion and discuss the result with the teacher.

It will be understood that the student has passed the continuous evaluation when all the following requirements are met:

1. 75% of the practices of the subject have been correctly developed.

2. At least a grade of 5 out of 10 (passed) has been obtained in the last test type test (which will cover all the contents seen in the subject).

3. The weighted average of the marks obtained in the test type tests is a minimum of 5 out of 10 (passed), this being the grade obtained in the subject.

In order for the student to be able to take the evaluation tests indicated in this point, the student must meet the first requirement expressed in the previous paragraph.

If the weighted average of the marks obtained in the test type tests is greater than or equal to 5 but the grade obtained in the last test type test is less than 5, the student will not have passed the subject and his grade will be the one obtained in the second test.

It will be understood that a student has opted for continuous assessment when, fulfilling the necessary requirements regarding the completion of practices, participates in the second test type test.

The qualification obtained in the test and practice tests will only be valid for the academic year in which they take place.

3. Students who do not opt for continuous assessment

Students who do not opt for continuous assessment will be offered an evaluation procedure that allows them to reach the highest grade. This procedure will consist of a final exam (whose date is set by the Management of the Center), in which all the contents developed in the subject will be evaluated, both in the theory classes and in the practical classes. This final exam will consist of two parts: a theory test in a test-type format, which will represent 30% of the final grade, and another part of practice, which will be the remaining 70%, and which will consist of a series of exercises to be developed. It is an essential condition to pass the subject to obtain a minimum score of 5 out of 10 (Approved) in the test type test. In case of not passing the test type test, the final grade of the student will be the one obtained in said test evaluated on 3.

Only those students who do not perform any of the assessment tests included in this teaching guide will be considered "not submitted". Specifically, for those students who take the first test type test but then do not take the second test type test and do not show up for the final exam, their grade in the subject will be the grade obtained in the first test type test evaluated on 3.

4. About the July call

The call for recovery (July) will consist of a final exam that will be 100% of the final grade and in which all the contents developed in the subject will be evaluated, both in the theory classes and in the practical classes. This exam will consist of two parts: a theory test in test format, which will mean 30% of the final grade, and another practice, which will be the remaining 70%, and which will consist of a series of exercises to be developed. It is an essential condition to pass the subject to obtain a minimum score of 5 out of 10 (Approved) in the test type test. In case of not passing the test type test, the final grade of the student will be the one obtained in said test evaluated on 3.

5. Prohibition of the use of electronic devices

The use of any electronic device during the evaluation tests will not be allowed, unless expressly authorized. The fact of introducing an electronic device not authorized in the examination room, will be considered a reason for not passing the subject in this academic year and the overall rating will be suspended (0,0).

Sources of information

Basic Bibliography

Barroso Castro, C. (Coord.), **Economía de la empresa**, 2012,

Moyano Fuentes, J.; Bruque Cámara, S.; Maqueira Marín, J.M.; Fidalgo Bautista, F.A.; Martínez Jurado, **Administración de empresas: un enfoque teórico-práctico**, 2011,

García Márquez, F., **Dirección y Gestión Empresarial**, 2013,

Iborra Juan, M.; Dasi Coscollar, A.; Dolz Dolz, C.; Ferrer Ortega, C., **Fundamentos de dirección de empresas. Conceptos y habilidades directivas**, 2014,

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Basics of operations management/V12G320V01605

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on criteria of safety, health and responsibility , and guaranteeing teaching in a non-classroom or partially classroom setting. These measures already planned guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance by students and teachers through the standardized and institutionalized tool of the teaching guides.

=== ADAPTATION OF THE METHODOLOGIES ===

The teaching activity will be carried out through Campus Remoto, also using the FAITIC e-learning platform. Other supplementary platforms may be used to guarantee the accessibility to teaching contents.

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

=== ADAPTATION OF THE TESTS ===

In order to adapt the teaching guide to the exceptional planning, the assesment proceesses would consist of the following evaluable activities:

1. CONTINUOUS ASSESMENT

a) Several tests that will be carried out throughout the course on the different parts of the syllabus, depending on the topics anlyzed in both theory and practical classes, as well as the material provided to prepare them. Taking these tests, the student may achieve a maximum score of 6 points.

b) The student will also obtain points for each of the practices successfully passed throughout the course, achieving a maximum score of 1.5 points.

c) A final test with a maximum score of 2.5 points, covering issues related to the entire syllabus, will be carried out on the official date for the final exam of the course set by the governing bodies of the Escola de Inxenería Industrial.

None of these activities will be recoverable, that is, if a student cannot perform them on the stipulated date, the professor is not obliged to repeat them, except for justified cause duly accredited by the student.

The score obtained in the tests and in the practices will only be valid for the academic course in which they are carried out.

2. NON-CONTINUOUS ASSESSMENT

A test with a maximum score of 10 points and covering issues related to the entire syllabus of the subject will be carried out on the official date set by the governing bodies of the Escola de Inxenería Industrial.

Students may renounce continuous assessment and opt for non-continuous assessment by written request to the professor, within the period established for this purpose and this period will be announced in advance.

3. NON ORDINARY EXAM IN JUYLY

Non ordinary exam in July will consist of a test with a maximum score of 10 points and that will cover issues related to the entire syllabus of the course. That test will be carried out on the official date set by the governing bodies of the Escola de Inxenería Industrial.

All the evaluable activities will be carried out through the telematic resources provided by the University of Vigo for this purpose, and following the measures set by the governing bodies of the University of Vigo.

Only those students who do not take any of the assessment tests included in this teaching guide will be considered as not submitted.

IDENTIFYING DATA				
Physics: Physics 2				
Subject	Physics: Physics 2			
Code	V12G360V01202			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Fernández, José Luís			
Lecturers	Añel Cabanelas, Juan Antonio Blanco García, Jesús Fernández Fernández, José Luís Legido Soto, José Luís López Vázquez, José Carlos Lusquiños Rodríguez, Fernando Paredes Galán, Ángel Pérez Davila, Sara Quintero Martínez, Félix Ribas Pérez, Fernando Agustín Sánchez Vázquez, Pablo Breogán Soto Costas, Ramón Francisco			
E-mail	jlfdez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This undergraduate course is the second quarter of introductory physics. The focus is on electricity, magnetism and thermodynamics			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.

Learning outcomes	Competences		
Understanding the basic concepts of electromagnetism and thermodynamics.	CG3	CE2	
Knowing the basic instruments for the measurement of physical quantities.		CE2	
Knowing the basic techniques for experimental data evaluation.	CG3	CE2	CT9 CT10
Ability to develop practical solutions to basic technical problems in engineering, within the framework of electromagnetism and thermodynamics.	CG3	CE2	CT2 CT9 CT10

Contents	
Topic	
1.- ELECTRIC CHARGE AND ELECTRIC FIELD	1.1.- Electric Charge. 1.2.- Conductors, Insulators and Induced Charges. 1.3.- Coulomb□s Law. 1.4.- Electric Field and Electric Forces. 1.5.- Electric Field Calculations. 1.6.- Electric Field Lines. 1.7.- Electric Dipoles.
2.- GAUSS'S LAW	2.1.- Charge and Electric Flux. 2.2.- Calculating Electric Flux. 2.3.- Gauss's Law. 2.4.- Applications of Gauss's Law. 2.5.- Conductors in Electrostatic Equilibrium.

3.- ELECTRIC POTENTIAL	3.1.- Electric Potential Energy. 3.2.- Electric Potential. 3.3.- Calculating Electric Potential. 3.4.- Equipotential Surfaces. 3.5.- Potential Gradient.
4.- CAPACITANCE AND DIELECTRICS	4.1.- Capacitors and Capacitance. 4.2.- Capacitors in Series and Parallel. 4.3.- Energy Storage in Capacitors and Electric-Field Energy. 4.4.- Dielectrics, Molecular Model of Induced Charge, and Polarization Vector. 4.5.- Gauss's Law in Dielectrics. 4.6.- Dielectric Constant and Permittivity.
5.- CURRENT, RESISTANCE, AND ELECTROMOTIVE FORCE	5.1.- Electric Current. 5.2.- Current and Current Density. 5.3.- Ohm□s Law and Resistance. 5.4.- Electromotive Force and Circuits. 5.5.- Energy and Power in Electrical Circuits. 5.6.- Basic Theory of Electrical Conduction.
6.- MAGNETIC FIELD	6.1.- Magnetic Field. 6.2.- Motion of Charged Particles in a Magnetic Field. 6.3.- Magnetic Force on a Current-Carrying Conductor. 6.4.- Force and Torque on a Current Loop. 6.5.- Biot-Savart□s Law. 6.6.- Magnetic Field Lines and Magnetic Flux. 6.7.- Ampère□s Law.
7.- MAGNETIC FIELD IN MATTER	7.1.- Magnetic Substances and Magnetization Vector. 7.2.- Ampère□s Law in Magnetic Media. 7.3.- Magnetic Susceptibility and Permeability. 7.4.- Paramagnetism and Diamagnetism. 7.5.- Ferromagnetism.
8.- ELECTROMAGNETIC INDUCTION	8.1.- Induction Experiments. 8.2.- Faraday-Lenz's Law. 8.3.- Induced Electric Fields. 8.4.- Eddy Currents. 8.5.- Mutual Inductance. 8.6.- Self-Inductance and Inductors. 8.7.- Magnetic-Field Energy.
9.- THERMODYNAMIC SYSTEMS	9.1.- Classical Thermodynamics. 9.2.- Thermodynamic Systems and Classification. 9.3.- State Variables and State of a System. 9.4.- Equations of State. 9.5.- Thermodynamic Equilibrium. 9.6.- Change of State, Transformation or Process. 9.7.- Quasi-static Processes. 9.8.- State and Process Functions.
10.- TEMPERATURE AND HEAT	10.1.- Thermal Equilibrium, The Zeroth Law of Thermodynamics, and Temperature. 10.2.- Thermometers and Temperature Scales. 10.3.- Ideal Gas Thermometers and the Kelvin Scale. 10.4.- Heat. 10.5.- Calorimetry and Heat Capacities.
11.- THE FIRST LAW OF THERMODYNAMICS	11.1.- Work. 11.2.- Work Done During Volume Changes. 11.3.- Internal Energy. 11.4.- The First Law of Thermodynamics. 11.5.- Internal Energy of an Ideal Gas. 11.6.- Molar Heat Capacities of an Ideal Gas. 11.7.- Adiabatic, Isothermal, Isobaric and Isochoric Processes for an Ideal Gas. 11.8.- Enthalpy.

12.- THE SECOND LAW OF THERMODYNAMICS	12.1.- Directions of Thermodynamic Processes. 12.2.- Heat Engines, Refrigerators, and Heat Pumps. 12.3.- The Second Law of Thermodynamics: Clausius and Kelvin-Planck Statements. 12.4.- Carnot Engine. 12.5.- Carnot Theorems. 12.6.- Thermodynamic Temperature. 12.7.- Entropy. 12.8.- Increase of Entropy Principle. 12.9.- Entropy Change of an Ideal Gas.
LABORATORY	1.- How to Use a Multimeter. Ohm□s Law. Direct Current. Circuit with Resistors. 2.- Linear and Non-Linear Conductors. 3.- Charge and Discharge of a Capacitor. 4.- Analysis of a Parallel Plate Capacitor with Dielectrics. 5.- Utilization of an Oscilloscope to Analyze Charge and Discharge Processes. 6.- Study of the Magnetic Field. Helmholtz Coils. Magnetic Moment. Hall Effect. 7.- Calorimetry. Water Equivalent of Calorimeter. Latent Heat of Fusion. 8.- Thermodynamics of the Ideal Gas. Heat Capacity Ratio. Adiabatic Work.
LABORATORY: UNSTRUCTURED ACTIVITY (OPEN LAB) SESSIONS	Unstructured activity (open lab) sessions that cover the topics of the above cited regular laboratory sessions. A practical problem will be assigned to each team. Then, under the teacher□s supervision, each team must analyse the problem, select a theoretical model and experimental means to obtain a solution.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	24.5	45	69.5
Problem solving	8	20	28
Laboratory practical	18	18	36
Objective questions exam	1	0	1
Problem and/or exercise solving	3.5	0	3.5
Essay questions exam	3	0	3
Report of practices, practicum and external practices	0	9	9

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

Methodologies

	Description
Lecturing	Lectures are given by the teacher on the contents of the subject, theoretical bases and / or guidelines of a work, exercise or project to be performed by the students.
Problem solving	Activity in which problems and / or exercises related to the subject are formulated. The student must develop the appropriate or correct solutions through the repetition of routines, the application of formulas or algorithms, the application of procedures for transforming the available information and the interpretation of the results. It is usually used as a complement to the lecture sessions.
Laboratory practical	Activities for applying the knowledge to particular situations and for the acquisition of basic and procedural skills related to the subject. They are developed in dedicated rooms with specialized equipment (laboratories, computer rooms, etc.).

Personalized assistance

Methodologies	**Description**
Lecturing	In office hours.
Laboratory practical	In office hours.
Problem solving	In office hours.
Tests	**Description**
Objective questions exam	In office hours.
Problem and/or exercise solving	In office hours.
Essay questions exam	In office hours.
Report of practices, practicum and external practices	In office hours.

Assessment

	Description	Qualification	Evaluated Competencess		
Objective questions exam	Tests for the assessment of acquired knowledge that include closed questions with different response options (true/false, multiple choice, matching of elements...). Students select a response among a limited number of choices.	10	CG3	CE2	
Problem and/or exercise solving	Test in which the student must solve a series of problems and / or exercises in a time / conditions set by the teacher. In this way, the student should apply the acquired knowledge.	40	CG3	CE2	CT2
Essay questions exam	Tests that include open questions on a topic. Students should develop, relate, organize and present knowledge on the subject in an argued response.	40	CG3	CE2	
Report of practices, practicum and external practices	Preparation of a report by the students which reflects the characteristics of the work that has been carried out. Students must describe the developed tasks and procedures, show the results or observations made, as well as the data analysis and processing.	10	CG3	CE2	CT9 CT10

Other comments on the Evaluation

Continuous assessment (denoted EC) will have a weight of 40% in the final mark, and will include the lab mark (20%, denoted ECL) and the class mark (20%, denoted ECA).

The mark ECA will be evaluated by means of tests on the topics covered in the lectures. These tests will comprise objective questions and/or essay questions.

The mark ECL will be evaluated by the lab reports and tests on the topics covered in the laboratory sessions.

Those students unable to attend the continuous assessment and who have been granted the waiver of the continuous assessment have the possibility of taking a final test to obtain a REC mark with a weight of 40% of the final mark. This test will include the contents of the lab sessions (weight of 20%, denoted RECL) and the topics covered in the lectures (weight of 20%, denoted RECA).

The remaining 60% of the final mark will be obtained by taking a final exam. This will consist of two parts: a theoretical part (denoted T) with a weight of 20% of the final mark, and another part on problem solving (denoted P) with a weight of 40% of the final mark. The theoretical part will consist of a test comprising objective questions and/or essay questions. Those students not attending the final exam will obtain a mark of non-presented.

Both the "fin de carrera" exam and any other ones held on dates and/or times different from those officially set by the School of Industrial Engineering (E.E.I.), could have an exam format different from the one previously described, although each part of the exam (EC or REC, T and P) will hold its weight in the final mark.

Final mark G for the continuous assessment modality:

G = ECL + ECA + T + P.

Final mark G for the assessment at the end of the course and July (RECL and RECA only for those students who have been granted the waiver of the continuous assessment):

G = ECL (or RECL) + ECA (or RECA) + T + P.

To pass the course, a student must obtain a final mark G equal to or higher than 5.

Ethical commitment: Every student is expected to follow an appropriate ethical behaviour. In the case that unethical conduct is detected (copy, plagiarism, utilisation of unauthorised electronic devices, or others), it will be considered that the student does not fulfil the necessary requirements to pass the subject. In this case, the final mark in the present academic year will be "suspenso" (0.0).

Students should not possess or use any electronic device during the tests and exams, unless specifically authorised to do so. The mere fact that a student carries an unauthorised electronic device into the examination room will result in failing the subject in the present academic year and the final mark will be "suspenso" (0.0).

Sources of information

Basic Bibliography

1. Young H. D., Freedman R. A., **Física Universitaria, V1 y V2**, 13ª ed., Pearson,

1en. Young H. D., Freedman R. A, **University physics: with modern physics**, 14th ed., Pearson,

Complementary Bibliography

2. Tipler P., Mosca G., **Física para la ciencia y la tecnología, V1 y V2**, 5ª ed., Reverté,

2en. Tipler P., Mosca G, **Physics for Scientists and Engineers, V1 and V2**, 6th ed., W. H. Freeman and Company,

3. Serway R. A., Jewett J. W, **Física para ciencias e ingeniería, V1 y V2**, 9ª ed., Cengage Learning,

3en. Serway R. A., Jewett J. W, **Physics for Scientists and Engineers**, 9th ed., Brooks/Cole,

4. Juana Sardón, J. M., **Física general, V1 y V2**, 2ª ed., Pearson Prentice-Hall,

5. Bronshtein, I., Semendiaev, K., **Manual de matemáticas para ingenieros y estudiantes**, 4ªed., MIR 1982; MIR-Rubiños 1993,

5en. Bronshtein, I., Semendiaev, K., **Handbook of Mathematics**, 5th Ed., Springer Berlin,

6. Jou Mirabent, D., Pérez García, C., Llebot Rabagliati, J. E., **Física para ciencias de la vida**, 2ª ed., McGraw-Hill Interamericana de España S.L.,

7. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos**, 1ª ed., ECU,

8. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos, Volumen II**, 1ª ed., ECU,

9. Villar Lázaro, R, López Martínez, C., Cussó Pérez, F., **Fundamentos Físicos de los Procesos Biológicos, Volumen III**, 1ª ed., ECU,

10en. Villars, F., Benedek, G. B., **Physics with Illustrative Examples from Medicine and Biology**, 2nd ed., AIP Press/Springer-Verlag,

Recommendations

Other comments

Basic recommendations:
1. Basic knowledge acquired in the subjects of Physics and Mathematics in previous courses.
2. Oral and written comprehension.
3. Capacity for abstraction, basic calculus, and synthesis of information.
4. Skills for group work and communication.

In the event of discrepancy, the Spanish version of this syllabus prevails.

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
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* Teaching methodologies modified
All the methodologies (lecturing, problem solving and laboratory practical): in the blended learning regime face-to-face classroom activities will be combined with online lecturing through the virtual campus (Campus Remoto), using FAITIC platform as an additional support. In the distance learning regime, online lecturing will take place through virtual campus (Campus Remoto), using FAITIC platform as an additional support as well. To guarantee the access of the students to the materials and resources of the course other methodologies and media could be implemented if needed.
Laboratory practicals: in blended learning, the operation of experimental devices by the students and the associated data acquisition activities could suffer major restrictions. These activities will be mostly replaced by demonstrations developed by the lecturer in the lab and watched by the students attending the lab session. These demonstrations could be followed online by the rest of the students. Data processing and analysis are greatly independent of the operation of experimental devices and can be developed outside the laboratory (in another classroom, at home, etc..), so such activities could be realized by students attending the lab as well as by students participating online. In the distance learning regime, the laboratory practicals will be developed entirely online and the operation of experimental devices and data acquisition activities to be done by the students will be completely replaced by demonstrations developed by the lecturer and/or specific audiovisual materials.

* Non-attendance mechanisms for student attention (tutoring)
Office hours and tutoring could be developed both face-to-face (provided that safety can be guaranteed) or online, by using asynchronous media (email, forum, etc.) or by videoconference (by making an appointment).

* Modifications (if applicable) of the contents
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* Additional bibliography to facilitate self-learning
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* Other modifications
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=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
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* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
Final exam, part P 40%, the weight of the exam is maintained.
Final exam, part T 20%, the weight of the exam is maintained.

* Tests that are modified
[Previous test] => [New test]
ECA 20%, types of tests may include: objective questions exam, essay questions exam => ECA 20%, types of tests may include: objective questions exam, essay questions exam, problem and/or exercise solving.
ECL 20%, types of tests may include: essay questions exam, practices report 10% => ECL 20%, types of tests may include: essay questions exam, problem and/or exercise solving, practices report 10%.

* New tests
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* Additional Information
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IDENTIFYING DATA				
Computer science: Computing for engineering				
Subject	Computer science: Computing for engineering			
Code	V12G360V01203			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Rajoy González, José Antonio Rodríguez Damian, María			
Lecturers	Ibáñez Paz, Regina Pérez Cota, Manuel Rajoy González, José Antonio Rodríguez Damian, Amparo Rodríguez Damian, María Rodríguez Diéguez, Amador Sáez López, Juan Vázquez Núñez, Fernando Antonio			
E-mail	mrdamian@uvigo.es jarajoy@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	They treat the following contents: Methods and basic algorithms of programming Programming of computers by means of a language of high level Architecture of computers Operating systems basic Concepts of databases			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE3	CE3 Basic knowledge on the use and programming of computers, operating systems, databases and software applications in engineering.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT7	CT7 Ability to organize and plan.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
Computer and operating system skills.	CG3	CE3	CT5 CT6 CT7
Basic understanding of how computers work	CG3	CE3	CT1 CT5
Skills regarding the use of computer tools for engineering	CG3	CE3	CT5 CT6 CT7 CT17
Database fundamentals	CG3	CE3	CT1 CT5 CT6 CT7

Capability to implement simple algorythims using a programming language	CG3 CG4	CE3	CT2 CT7 CT17
Structured and modular programming fundamentals	CG3 CG4	CE3	CT2 CT5 CT17

Contents	
Topic	
Basic computer architecture	Basic components Peripheral devices Communications
Basic programming concepts and techniques applied to engineering	Data structures Control structures Structured programming Information treatment Graphical user interfaces
Operating systems	Basic principles Types
Practical exercises that support and secure the theoretical concepts	Practical exercises that will allow the students to verify the concepts learned in class and see that using them they can solve problems
Computer tools applied to engineering	Types and examples

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Laboratory practical	22	30	52
Case studies	12	14	26
Lecturing	8	12	20
Objective questions exam	4	7	11
Laboratory practice	6	8	14
Essay questions exam	10	15	25
*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 related to estashing contact, gathering information from the students, organizing groups, as well as presenting the course.
Laboratory practical	Activities related to applying the knowledge obtained to specific situations and acquiring basic and procedimental skills related with the subject being studied. Developed in specialized spaces with specialized equipment (labs, computer rooms, etc).
Case studies	Analyze a fact, problem or real event with the purpose of knowing it, interpreting it, resolving it, generating hypothesis, contrasting data, thinking about it, gaining new knowledge, diagnosing it and training alternative solutions
Lecturing	Exhibition of the contents that make up the subject being studied on behalf of the profesor, theoretical principles and/or instructions regarding an assignment, exercise or project to be developed by the student.

Personalized assistance	
Methodologies	**Description**
Laboratory practical	Questions will be resolved during the laboratory sessions and the student will be shown the different options to solve a problem. Teachers' tutoring in the stipulated time and format.

Assessment					
	Description	Qualification	Evaluated Competencess		
Objective questions exam	Tests for evaluating aquired competencies that include cuestions from which the student must choose a response from a set of alternatives (true/false, multiple choice,...)	15	CG3	CE3	CT5

Laboratory practice	Tests for evaluating aquired competencies that include activities, problems or practical excercises to be solved.	70	CG3 CG4	CE3	CT1 CT2 CT5 CT6 CT7 CT17
Essay questions exam	Tests for evaluating aquired competencies that include cuestions regarding a subject. The students must develop, relate, organize and present their knowledge regarding the subject.	15	CG3 CG4	CE3	CT1 CT2 CT5 CT6 CT7

Other comments on the Evaluation

Ethical commitment:

Students are expected to behave ethically. If unethical behaviour is detected (copying,plagiarism, use of unauthorized electronic

devices and others), then it will beconsidered that the student does not meet the minimum requirements to pass thecourse. In this case, the final grade for the current academic year will befailed (0.0).

In additionto the ethical commitment, the following is underlined:
In the first place, a person registered in the course is by default subject to the continuous assessment system; if the student does not want to be in this system, the he/she must expressly renounce to it within the established deadlines.

CONTINUOUSASSESSMENT OPERATION

In the present course, the continuous assessment will collect all the evidence oflearning from the person enrolled and will be grouped into three assessments.The first two will take place preferably in the laboratories: Test 1 and Test2. The third evaluation may be written: Test 3. If the student does notrenounce to the continuous evaluation system, tests that are not attended will be considered as qualified as zero (0.0). A minimum score of 30% out of 10 (3.0points) must be obtained in the last two evaluations: Test 2 and Test 3, inorder to be eligible to have the final average calculated. If this requirementis not met and the final average is equal to or greater than 5, the final gradewill be 4:

Test 1 * 0.3 + (Test 2>=3) * 0. 4 + (Test 3>=3) * 0. 3 >=5

A studentis considered passed if he/she obtains a five or more in compliance with allthe requirements.

First call (May/June):

The following must be met to pass the subject under continuous assessment:
Test 1 * 0.3 + (Test 2>=3) * 0. 4 + (Test 3>=3) * 0.3 >= 5

Once thefirst evaluation: Test 1, has been carried out, the person enrolled may requestto abandon the continuous evaluation system (within the period and by the meansestablished by the teaching staff). In this way, the person enrolled will beable to follow the non-continuous assessment system.

Second call (June/July):

If a person does not reach the passing level in the first exam (May/June) but has passed the minimum mark in the second exam: Test 2, in the second call (June/July) he/she can choose to keep the grades of the first two tests, and take a 4-points exam, or take a 100% exam in the subject (10 points). If the person takes the 4-points test, he/she will be asked for a minimum score of 30% out of 10 (3. 0 points) in order to calculate the final grade. If this requirement is not met and the final average is equal to or greater than 5, the final grade will be 4.

NON-CONTINUOUS EVALUATION OPERATION

An exam that allows students to obtain 100% of the grade. The exam may be divided into sections, minimuns can be required.

First call (May/June):

Registered students who have expressly renounced to the continuous assessment system may take the May/June exam (on the date and at the time proposed by the School) and take an exam that allows them to obtain 100% of the grade. This exam is not open to those who have failed the continuous assessment.

Second call (June/July):

An exam will be proposed to evaluate 100% of the subject, for those who have not achieved the minimum mark in the first call.
The version of the guide was made in Spanish. For any doubt or contradiction, the Spanish guide will be mandatory.

Sources of information

Basic Bibliography

Eric Matthes, **Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming**, 2019
Sébastien Chazallet, **Python 3. Los fundamentos del lenguaje - 2ª edición**, 2016
Dictino Chaos García, **Introducción a la informática básica (GRADO)**, 2017

Complementary Bibliography

Tanenbaum, Andrew S.,, **Sistemas Operativos Modernos**, Pearson Education, 2009
Silberschatz, Abraham ,Korth Henry, Sudarshan, S.,, **Fundamentos de bases de datos**, McGraw-Hill,, 2014

Recommendations

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===

=== ADAPTATION OF THE METHODOLOGIES ===

* Educational methodologies mantained
The methodologies: lecturing, laboratory practical and the study of cases, will continue on being valid but supported by services, such as: Remote Campus, Moovi, or other that the University of Vigo has available at that moment.

* Educational methodologies modified: it won´t be necessary to modify any educational methodology because all they can be adapted.

* Mechanism to individual tutoring
Each professor involved will put in knowledge of the students the different ways to establish a channel of communication, these methods can be e-mail, theacher virtual office, forums, etc. This information will be always available to students.

* Additional bibliography to facilitate non-attendance education
The bibliography will be made available to students from the beginning of the course. The students can choose the resources that best suit their needs: manuals, solved exercises, videos, etc. Does not apply additional bibliography.

=== ADAPTATION OF THE EVALUATION ===

The evaluation criteria are maintained, adapting the performance of the tests, if necessary and by indication in the rectoral resolution.

* additional Information
The content of the subject will remain the same, and the different means that the University of Vigo makes available to us will be searched for, those that facilitate the transmission of knowledge and evaluation.

IDENTIFYING DATA				
Matemáticas: Cálculo II e ecuacións diferenciais				
Subject	Matemáticas: Cálculo II e ecuacións diferenciais			
Code	V12G360V01204			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego Inglés			
Department	Matemática aplicada I Matemática aplicada II			
Coordinator	Cachafeiro López, María Alicia			
Lecturers	Bazarra García, Noelia Cachafeiro López, María Alicia Calvo Ruibal, Natividad Castejón Lafuente, Alberto Elias Durany Castrillo, José Fernández García, José Ramón Godoy Malvar, Eduardo Martínez Brey, Eduardo Meniño Cotón, Carlos Rodal Vila, Jaime Alberto			
E-mail	acachafe@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	U obxectivo que se persegue con esta asignatura é que o alumno coñeza as técnicas básicas de o cálculo integral en varias variables, cálculo vectorial, ecuaciones diferenciales ordinarias e as súas aplicacións.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE1	CE1 Capacidade para a resolución dos problemas matemáticos que poidan presentarse 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	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT3	CT3 Comunicación oral e escrita de coñecementos.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.
CT15	CT15 Obxectivación, identificación e organización.
CT16	CT16 Razoamento crítico.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Comprensión de os conceptos básicos de o cálculo integral en varias variables.	CG3	CE1	CT1
Coñecemento de as principais técnicas de integración de funcións de varias variables.	CG3 CG4	CE1	CT1 CT2 CT9
Coñecemento de os principais resultados de o cálculo vectorial e aplicacións.	CG3 CG4	CE1	CT1 CT2 CT9
Adquisición de os coñecementos básicos para a resolución de ecuaciones e sistemas diferenciales lineais.	CG3 CG4	CE1	CT1 CT2 CT9
Comprensión de a importancia de o cálculo integral, cálculo vectorial e de as ecuaciones diferenciales para o estudo de o mundo físico.		CE1	CT9 CT16

Aplicación de os coñecementos de cálculo integral, cálculo vectorial e de ecuaciones diferenciales.	CE1	CT2 CT6 CT9 CT16
Adquisición de a capacidade necesaria para utilizar estes coñecementos en a resolución manual e informática de cuestións, exercicios e problemas.	CE1	CT1 CT2 CT3 CT6 CT9 CT15 CT16

Contidos	
Topic	
Integración en varias variables.	Integral dobre sobre rectángulos. Principio de Cavalieri. Redución a integrales iteradas. Integral dobre sobre rexións elementais. Propiedades. Teorema de Fubini. Teorema de o cambio de variable. Caso particular de coordenadas polares. Integral triplo sobre unha caixa e sobre rexións elementais. Teorema de Fubini. Teorema de o cambio de variable. Casos particulares: coordenadas cilíndricas e esféricas. Aplicacións geómetricas e físicas de a integral múltiple: cálculo de volumes, centros de masa e momentos de inercia.
Cálculo vectorial	Curvas no plano e no espazo. Lonxitude de arco. Cambio de parámetro. Integral curvilínea ou de traxectoria con respecto á lonxitude de arco de campos escalares. Integral curvilínea ou circulación de campos vectoriales. Propiedades. Teorema fundamental das integrais de liña. Teorema de Green no plano. Superficies regulares. Plano tangente. Vector normal. Área dunha superficie. Integral de superficie de campos escalares. Fluxo ou integral de superficie de campos vectoriales. Operadores diverxencia e rotacional. Caracterización de campos conservativos. Teorema de Stokes. Teorema de Gauss.
Ecuacións diferenciais	Ecuacións diferenciais ordinarias. Concepto de solución. Teoremas de existencia e unicidade para problemas de condición inicial. Métodos de resolución de ecuacións diferenciais ordinarias de primeira orde: en variables separables, reducibles a variables separables, homoxéneas, lineais e reducibles a lineais. Ecuacións diferenciais exactas. Factores integrantes. Ecuación diferencial dunha familia uniparamétrica de curvas planas. Traxectorias ortogonales. Ecuacións diferenciais lineais de orde 2 e de orde superior. Problemas de condición inicial. Conxuntos fundamentais. Método de variación de parámetros. Método de coeficientes indeterminados. Redución de orde. Ecuación de Euler. Sistemas de ecuacións diferenciais lineais.
Métodos numéricos para problemas de valor inicial	Introdución aos métodos numéricos. Métodos de Euler e Euler mellorado. Método de Runge-Kutta de orde 4.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32	60	92
Resolución de problemas	22	24	46
Prácticas de laboratorio	9	0	9
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	O profesor exporá nas clases teóricas os contidos da materia. Os alumnos terán textos básicos de referencia para o seguimento da materia.
Resolución de problemas	O profesor resolverá problemas e exercicios e o alumno terá que resolver exercicios similares para adquirir as capacidades necesarias.
Prácticas de laboratorio	O profesor resolverá problemas e exercicios de forma manual e/ou mediante o uso de ferramentas informáticas e o alumno terá que resolver exercicios similares para adquirir as capacidades necesarias.

Atención personalizada

Methodologies	Description
Resolución de problemas	O profesor atenderá persoalmente as dúbidas e consultas dos alumnos, en especial nas clases de problemas e laboratorio e en *tutorías.
Prácticas de laboratorio	O profesor atenderá persoalmente as dúbidas e consultas dos alumnos, en especial nas clases de problemas e laboratorio e en *tutorías.

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas	Realizarase probas escritas e/ou traballos.	40	CG3 CG4	CE1	CT1 CT2 CT3 CT6 CT9 CT15 CT16
Exame de preguntas de desenvolvemento	Realizarase una proba final sobre os contidos de toda a materia.	60	CG3 CG4	CE1	CT1 CT2 CT3 CT9 CT15 CT16

Other comments on the Evaluation

A avaliación continua levarase a cabo sobre os criterios anteriormente expostos. A cualificación final do alumno será a mellor nota entre a obtida mediante avaliación continua e a obtida na proba final.
Aqueles alumnos que non se acollan á avaliación continua serán evaluados cun exame final sobre os contidos de toda a materia que supoñerá o 100% da nota.
A avaliación dos alumnos en segunda convocatoria consistirá nun exame sobre os contidos da asignatura que supoñerá o 100% da nota.
Compromiso ético:
Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (por exemplo, copia, plagio, utilización de aparellos electrónicos non autorizados) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global da asignatura no presente curso académico será de suspenso con cualificación numérica de 0.

Bibliografía. Fontes de información

Basic Bibliography

Larson, R., Edwards, B.H., **Cálculo 2 de varias variables**, 9ª edición, McGraw-Hill, 2010

Marsden, E., Tromba, A.J., **Cálculo Vectorial**, 6ª edición, Pearson, 2018

Rogawski, J., **Cálculo: varias variables**, 2ª edición, Reverté, 2012

Thomas, G.B. Jr., **Cálculo: varias variables**, 12ª edición, Addison-Wesley-Pearson Education, 2010

García, A., López, A., Rodríguez, G., Romero, S., de la Villa, A., **Cálculo II. Teoría y problemas de funciones de varias variables**, 2ª edición, CLAGSA, 2002

Nagle, K., Saff, E.B., Snider, A.D., **Ecuaciones diferenciales y problemas con valores en la frontera**, 4ª edición, Pearson Educación, 2005

Zill, D.G., **Ecuaciones Diferenciales con aplicaciones de modelado**, 9ª edición, Cengage Learning, 2009

García, A., García, F., López, A., Rodríguez, G., de la Villa, A., **Ecuaciones Diferenciales Ordinarias**, CLAGSA, 2006

Kincaid, D., Cheney, W., **Métodos numéricos y computación**, 6ª edición, Cengage Learning, 2011

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Álxebra e estatística/V12G320V01103
Matemáticas: Cálculo I/V12G320V01104

Other comments

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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 ===

Si la situación sanitaria lo requiere, la actividad docente se realizará a través de Campus Remoto, utilizando también la plataforma de teledocencia FAITIC como refuerzo, todo ello sin perjuicio de poder utilizar medidas complementarias que garanticen la accesibilidad de los estudiantes a los contenidos docentes.

Las sesiones de tutorización se podrán llevar a cabo mediante medios telemáticos, bien de forma asíncrona (correo electrónico, foros de FAITIC, etc.) o bien mediante videoconferencia, en este caso mediante cita previa.

Información adicional.
Si los exámenes fuesen no presenciales, durante el período de corrección de los mismos, el estudiante podrá ser contactado por su profesor para aclarar aspectos de sus respuestas (auditoría) con el fin de evitar copias o plagios. La ausencia de explicaciones convincentes tendrá repercusión en la calificación del alumno.

IDENTIFYING DATA				
Chemistry: Chemistry				
Subject	Chemistry: Chemistry			
Code	V12G360V01205			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cruz Freire, José Manuel			
Lecturers	Alonso Gómez, José Lorenzo Álvarez Álvarez, María Salomé Bolaño García, Sandra Bravo Bernárdez, Jorge Cruz Freire, José Manuel Díez Sarabia, Aida María Iglesias Antelo, María Beatriz Meijide Fernández, Jéssica Moldes Moreira, Diego Nóvoa Rodríguez, Ramón Otero Martínez, Nicolás Ramos Berdullas, Nicolás Rey Losada, Francisco Jesús Salgado Seara, José Manuel Vecino Bello, Xanel			
E-mail	jmcruz@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This is a basic subject, common for all levels of the industrial fields studies. At the end of the course the students will have a basic knowledge about the principles of general chemistry, organic chemistry and inorganic chemistry, and its application to Industry. This knowledge will be further applied and expanded in other areas of the studies.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
CT2	CT2 Problems resolution.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
Learning outcomes			
Knowing the chemical bases of industrial technologies. Specifically, the student will gain basic knowledge of general, organic and inorganic chemistry and their applications in engineering. This will allow the student to apply the basic concepts and fundamental laws of chemistry. Due to theoretical-practical training, the student will be able to effectively carry out lab experiments and to solve basic chemistry exercises.	CG3	CE4	CT2 CT10 CT17

Contents
Topic

1. Atomic theory and chemical bonding	1.1 Atomic theory: Particles of the atom: Electron, proton et neutron. Characteristics of the atom: Atomic number and Atomic mass. Isotopes. Stability of the nucleus: Radioactivity (natural and artificial). Evolution of the atomic theory. 1.2. Chemical bonding: Definition. Intramolecular bonding: Covalent bonding and ionic bonding. Polyatomic molecules: hybridization and delocalization of electrons. Intermolecular bonding: Types of intermolecular forces.
2. States of aggregation: Solids, gases, pure liquids and solutions	2.1. Solid state: Introduction. Classification of solids: amorphous solids, molecular crystals and liquid crystals, Covalent crystals and ionic crystals. 2.2. Gaseous state: Characteristics of the gas phase. Ideal gases: Equation of state. Real gases: Equation of state. Properties of gases. 2.3. Liquid state: Characteristics of the liquid phase: physical properties (density, surface tension, viscosity). Changes of state. Phase diagram. Solutions: colligative properties
4.Chemical equilibrium: in gas phase, acid-base-base, redox, solubility	(4.1. Chemical equilibrium: Concept of Equilibrium. Equilibrium Constant. Types of equilibrium. The Le Chatelier Principe. 4.2. Acid-base Equilibrium: Definition of acid and base. Autoionization of water. Ionic Product. Concept of pH and pOH. Strength of acids and bases: Polyprotic acids. Amphoters. pH calculation. Acid-base titration. Buffer solutions. 4.3. Redox equilibrium: Concept of oxidation, reduction, oxidising agent, reducing agent. Balance of redox reactions in acid and alkaline media. Redox titration. Electrochemical cells: basic concepts and redox potential. Thermodynamics of electrochemical reactions: Gibbs Energy and cell Potential. Nernst Equation. Faraday□s Laws. 4.4 Solubility equilibrium: Soluble salts: Hydrolysis. Sparingly soluble salts: solubility and solubility product. Factors affecting solubility. Fractional Precipitation. Complex Salts: Definition, properties, dissociation and importance.
5. Chemical kinetics	5.1. Basic Concepts: Reaction Rate. Reaction Order. Kinetic Constant. Rate Equation. 5.2. Determination of the Rate Equation: Initial rate method. Integrated Rate Laws. 5.3. Factors affecting the Reaction Rate.
6. Basic principles of Organic Chemistry	6.1. Fundamentals of Organic formulation and functional groups: 6.1.1. ºStructure of the organic compounds: Alkanes, alkenes and alkynes. Aromatic Hydrocarbons. 6.1.2. Alcohols and phenols. 6.1.3. Ethers. 6.1.4. Aldehydes and ketones. 6.1.5. Esters. 6.1.6. Carboxylic acids and derivatives. 6.1.7. Amines and nitro-compounds.
7. Basic principles of Inorganic Chemistry.	7.1. Metallurgy and the Chemistry of Metals: Abundance of metals. Nature of the metallic bond, properties. Theory of the Conduction Band: conducting materials, semiconductors and superconductors. Metallurgical processes: iron and steel. 7.2. Non-metallic elements and their compounds: General properties. Hydrogen. Carbon. Nitrogen and phosphorous. Oxygen and sulphur. Halogens.
8. Applied Electrochemistry	8.1. Applications of the Nernst equation: Determination of pH, Equilibrium constant, solubility product. 8.2. Electrochemical cells: types of cells. Concentration Cells. Electric Conductivity in electrolytes. Electrolysis Cells. 8.3. Industrial Processes of electrolysis: electrodeposition (electroplating), electrometallurgy, electrolysis chlorine□caustic soda. Fuel cells.

9. Corrosion and treatment of Surfaces	9.1. Basic principles of Corrosion: the corrosión cell. 9.2. Corrosion of metals. 9.3. Corrosion rate. 9.4. Types of Corrosion. 9.5. Protection against Corrosion: Design considerations for Corrosion protection. Cathodic protection: sacrificial anodes and impressed current. Organic Coatings. Metallic coatings.
10. Electrochemical sensors	10.1. Fundamentals. 10.2. Typology and function. 10.3. Conductivity Sensors. 10.4. Potentiometric Sensors. 10.5. Ion Selective electrodes. pH sensors. 10.6. Sensors for gases in solution. 10.7. Enzyme-based sensors: Biosensors. 10.8. Amperometric and voltammetric sensors. 10.9. Applications of sensors: medicine, industry, environment.
11. Petroleum and derivatives. Petrochemistry	11.1. Physicochemical characteristics of petroleum (oil). 11.2. Physicochemical characteristics of natural gas. 11.3. Conditioning and uses of natural gas. 11.4. Drilling and crude oil extraction. 11.5. Fractioning of oil. 11.6. Cracking, alkylation, reforming and isomerisation of hydrocarbons. 11.7. Treatment of sulphurous compounds and refining units.
12. Carbon: Carbochemistry	(12.1. Formation of carbon. 12.2. Types of carbons and their constitution. 12.3. Technological uses of carbon. 12.4. Pyrogenation of carbon. 12.5. Hyidrogenation of carbon. 12.6. Direct liquefaction of carbon. Gasification.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	45	77
Problem solving	10	12	22
Laboratory practical	5.4	7.6	13
Autonomous problem solving	0	25.5	25.5
Objective questions exam	1	0	1
Problem and/or exercise solving	3	0	3
Report of practices, practicum and external practices	1	7.5	8.5

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

Methodologies

	Description
Lecturing	Presentation by the faculty member of the theoretical content of the subject using audiovisual media.
Problem solving	Activity in which problems and/or exercises related to the subject will be formulated. Students should develop appropriate solutions by applying formulas or algorithms to manage the available information and interpret the results.
Laboratory practical	Activities of application of the theoretical background to specific situations, aimed to the acquisition of basic skills related to the subject. Will be developed in the laboratories or computer rooms of the center in which subject is given. Those rooms will be equipped with the necessary specialized equipment.
Autonomous problem solving	Activity in which the teacher formulates problems and/or exercises related to the subject, and the student must develop the analysis and resolution in an autonomous way.

Personalized assistance

Methodologies	Description
Lecturing	Any doubt related with the contents given in the mater sessions will be clarified.
Problem solving	Any doubt related with the problems resolved in the seminars of problems will be answered.
Laboratory practical	Any doubt related with the laboratory practices will be answered.

Assessment

	Description	Qualification	Evaluated Competencess		
Autonomous problem solving	Students must solve independently, and periodically submit problems or exercises formulated by the faculty member. The results and the procedure followed in the execution will be evaluated. According to current legislation, the final grade will be numeric and between 0 and 10.	10	CG3	CE4	CT2 CT10
Objective questions exam	The purpose of these tests, which will be carried out in the date of the official announcement of examinations, is to assess the level of theoretical knowledge acquired by students in classroom sessions. Written tests are multiple choices, multiple responses, in which students can achieve a numerical score between 0 and 10, according to current legislation.	40	CG3	CE4	CT10
Problem and/or exercise solving	The evaluation of the knowledge gained by students in seminars will be through a written exam, in the official announcement of examinations, in which the student must solve 4 or 5 problems related to the subject under study. The exam will be graded according to the current legislation, with a numerical final grade between 0 and 10.	40	CG3	CE4	CT2 CT10
Report of practices, practicum and external practices	After each laboratory session, the student should answer an oral question or prepare a detailed report including aspects such as objective and theoretical foundations, procedure followed, materials used, results and interpretation. The aspects considered in the evaluation are the content of the report, the understanding of the work done, the ability of summarising, quality of presentation, and the personal contribution. The final score, between 0 and 10, will be the average of the marks obtained in the various reports made and/or writing or oral test that could be done for each practice.	10		CE4	CT17

Other comments on the Evaluation

The final exam, consisting of two different parts, a test-type quiz for theory content and a set of exercises, will be considered for the final score weighting only when they were rated greater than or equal to 4. Although the average score could be equal or greater than 5, if the qualification of any of the parts of the final exam be lower than 4, the final score will be the lowest mark obtained in the final exam (which is the one that does not permit to calculate the average mark). The attendance to any lab session or any seminar test means that the student is being evaluated and therefore a qualification of "not presented" is no longer possible.

The marks of continuous evaluation (seminars test and lab experiments) and the marks of final exam higher than 5 (test quiz or exercises) obtained in the first call will be kept for the second call.

Those students that obtain officially the renunciation to the continuous evaluation will be evaluated by the final exam, to be held in the official date for the two calls. The final qualification will consist of a 50% of exercises and a 50% of theory (test-type) exam. A rate equal to or greater than 4 in both parts is necessary in order to pass the exam.

Ethical commitment:

The student is expected to present an adequate ethical behavior. If an unethical behavior is detected (copying, plagiarism, unauthorized use of electronic devices, and others) it is considered that the student does not meet the requirements for passing the subject. In this case, the final grade in the current academic year will be FAIL (0.0 points).

The use of electronic devices during the assessment tests will be not permitted. Introducing an unauthorized electronic device into the examination room, will be considered as a FAIL (0.0 points) in the current academic year.

Sources of information

Basic Bibliography

Chang, R., **Química**, Ed. McGraw Hill,

Petrucci, R. H., Herring, F.G., Madura, J.D., Bissonnette, C., **Química General**, Ed. Prentice-Hall,

Reboiras, M.D, **Química. La ciencia básica**, Ed. Thomsom,

Fernández, M. R. y col., **1000 Problemas de Química General**, Ed. Everest,

Reboiras, M.D., **Problemas resueltos de de Química. La ciencia básica**, Ed. Thomson,

Complementary Bibliography

Atkins, P. y Jones, L, **Principios de Química. Los caminos del descubrimiento**, Ed. Interamericana,

Herranz Agustin, C, **Química para la ingeniería**, Ediciones UPC,

McMurry, J.E. y Fay, R.C, **Química General**, Ed. Pearson,

Herranz Santos, M.J. y Pérez Pérez M.L., **Nomenclatura de Química Orgánica**, Ed. Síntesis,

Quiñoá, E. y Riguera, R., **Nomenclatura y representación de los compuestos orgánicos : una guía de estudio y autoevaluación**, Ed. McGraw Hill,

Soto Cámara, J. L., **Química Orgánica I: Conceptos Básicos**, Ed. Síntesis,

Soto Cámara, J. L., **Química Orgánica II: Hidrocarburos y Derivados Halogenados**, Ed. Síntesis,

Ballester, A., Verdeja, L. y Sancho, J., **Metalurgia Extractiva I: Fundamentos**, Ed. Síntesis,

Sancho, J. y col., **Metalurgia Extractiva II: Procesos de obtención**, Ed. Síntesis,

Rayner-Canham, G., **Química Inorgánica Descriptiva**, Ed. Prentice-Hall,

Alegret, M. y Arben Merckoci, **Sensores electroquímicos**, Ediciones UAB,

Cooper, J. y Cass, T., **Biosensors**, Oxford University Press,

Calleja, G. y col., **Introducción a la Ingeniería Química**, Ed. Síntesis,

Coueret, F., **Introducción a la ingeniería electroquímica**, Ed. Reverté,

Otero Huerta, E., **Corrosión y Degradación de Materiales**, Ed. Síntesis,

Pingarrón, J.M. y Sánchez Batanero, P., **Química Electroanalítica. Fundamentos y Aplicaciones**, Ed. Síntesis,

Ramos Carpio, M. A., **Refino de Petróleo, Gas Natural y Petroquímica**, Ediciones UPM,

Vian Ortuño, A., **Introducción a la Química Industrial**, Ed. Reverté,

Herrero Villén, M.A., Atienza Boronat, J.A., Nogera Murray, P. y Tortajada Genaro, L.A., **La Química en problemas. Un enfoque práctico**, Ediciones UPV,

Quiñoa ,E., **Cuestiones y ejercicios de química orgánica: una guía de estudio y autoevaluación**, Ed. McGraw Hill,

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

Sánchez Coronilla, A., **Resolución de Problemas de Química**, Ed. Universidad de Sevilla,

Brown, L.S., Holme, T.A., **Chemistry for engineering students**, Brooks/Cole Cengage Learning, 3rd ed.,

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G350V01102
Mathematics: Algebra and statistics/V12G350V01103
Mathematics: Calculus 1/V12G350V01104

Other comments

It is recommended that students have taken and passed the subject of ""Chemistry"" in second baccalaureate or, alternatively, passed a specific test of access to the Degree.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

=== EXCEPTIONAL MEASURES SCHEDULED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on safety, health and responsibility criteria and guaranteeing teaching in a non-classroom or partially classroom setting. 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 by the students and teachers through the standardized tool and institutionalized teaching guides or syllabus.

=== ADAPTATION OF THE METHODOLOGIES ===

All the teaching methodologies explained in the syllabus are maintained, but the lectures will be performed by means of the Remote Campus of the University of Vigo.
If the lab practices could not be developed in person, the theoretical content will be explained by Remote Campus. Moreover, some videos recorded by the teachers will be provided, so that the student could see the procedure that should be done. Then, the students will be provided with experimental data, so that they can complete the corresponding lab report.
Office hours could be carried out in different modalities: in person, by email or through the virtual offices at the Remote Campus of the University of Vigo.

=== ADAPTATION OF THE EVALUATION ===

Modification of the evaluation tests:
Autonomous problem solving: the student must periodically deliver the problems or exercises formulated by the teacher; this topic increase their weight in the grade from 10% to 30%.
Problem solving and / or exercises: The final problem exam, to be held on the official dates set by the EEI, reduces its weight in the final grade, from 40% to 20%. The test will be graded with a final numerical grade between 0 and 10.
Multiple choice test: The final theory exam will be carried out on the official dates set by the EEI; it will be a multiple-choice test; it reduces its weight in the final grade from 40% to 20%. The test will be graded with a final numerical grade between 0 and 10.
Lab Practices report: The qualification of the laboratory practices maintains a weight of 10% in the final grade.
Autonomous resolution of theory questionnaires: These new continuous assessment tests are added; the student must carry out theory multiple-choice tests, which will have a weight of 20% in the final grade.

Considering that some students could be unable to do some test of continuous assessment, two possible procedures of qualification will be considered. The selected one will be the most favorable for each student in the two calls. The two procedures of weighing are:
a) Final score = theory exam x 0.2 + problem exam x 0.2 + continuous evaluation problems x 0.3 + continuous evaluation theory x 0.2 + lab practice x 0.1
b) Final score = theory exam x 0.5 + problem exam x 0.5

A grade greater than or equal to 4.0 in both the final theory exam and in the problem exam will be required in order to pass the subject in both weighting systems.

For the second call, the continuous evaluation grades obtained throughout the course are maintained, as well as the scores equal to or greater than 5.0 of the multiple-choice tests or problems exam obtained in the first call.

Those students who officially obtain the renounce of continuous assessment will do, on the official exam date of the two calls, a problem exam and a theory multiple-choice test, which will be weighted by 50% each of them in their grade. A grade greater than or equal to 4.0 in each exam will be a requirement.

IDENTIFYING DATA				
Materials science and technology				
Subject	Materials science and technology			
Code	V12G360V01301			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Figueroa Martínez, Raúl Abreu Fernández, Carmen María			
Lecturers	Abreu Fernández, Carmen María Cortes Redin, María Begoña Díaz Fernández, Belén Figueroa Martínez, Raúl			
E-mail	cabreu@uvigo.es raulfm@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of this subject is to introduce the main concepts of materials technology as well as to study applications of the most common materials			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG6	CG6 Capacity for handling specifications, regulations and mandatory standards.
CE9	CE9 Knowledge of the fundamentals of the science, technology and chemistry of materials. Understand the relationship between microstructure, the synthesis, processing and properties of materials.
CT1	CT1 Analysis and synthesis.
CT5	CT5 Information Management.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
It comprises the fundamental concepts of link, structure and microstructure of the distinct types of materials	CG3	CE9	CT10
It comprises the influence of the microstructure of the material on its mechanical , electrical, thermal and magnetic behaviour	CG3	CE9	
It comprises the mechanical behaviour of the metallic, ceramic, plastics and composite materials.	CG4 CG6		
It knows how to modify the material properties by means of mechanical processes and thermal treatments	CG4	CE9	CT9
It knows the basic structural characterisation techniques for materials.	CG3 CG6	CE9	
To acquire skills in the handle of the diagrams and charts			CT1
To acquire skills in the realisation of tests	CG6	CE9	CT10
It analyses the results obtained and extracts conclusions from them			CT1 CT5 CT9
It is able to apply norms of materials testing	CG6		CT1 CT9

Contents	
Topic	
Introduction	Introduction to the Science and Technology of Material. Classification of the materials. Terminology. Orientations for the follow-up of the matter.

Crystalline arrangement.	Crystalline and amorphous solids. Crystalline lattices, characteristics and imperfections. Allotropic transformations.
Properties of materials. Laboratory practices.	Mechanical, chemical, thermal, electric and magnetic properties. Standars for materials analysis. Compressive and tensile deformation. Principles of fracture mechanisms. Toughness. Hardness. Main test methods. Introduction to metallography. Binary isomorphous and eutectic systems. Microstructure in eutectic alloys. Analyses of practical situations.
Metallic materials.	Solidification. Constitution of alloys. Grain size. Main binary phase diagrams. Processing. Carbon steels: classification and applications. Cast iron alloys. Heat treatments: ims, fundamentals and classification. Annealing, normalizing, quenching and tempering. Nonferreous alloys.
Polymers and composites	General concepts. Classification. Properties. Types of polymers. Processing. Classification of composite materials. Polymer matrix composite materials. Processing of composite materials. Problems related to polymeric and composite materials.
Ceramic materials	Structure and bonding in ceramic materials. Silicates structure. Glasses. Properties of ceramic materials. Processing of ceramic materials. Applications.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	31	56	87
Laboratory practical	18	18	36
Autonomous problem solving	0	12	12
Mentored work	0.5	7.95	8.45
Problem and/or exercise solving	1	0	1
Presentation	0.25	0	0.25
Report of practices, practicum and external practices	0	2	2
Self-assessment	0	0.3	0.3
Objective questions exam	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	A presentation of the course is made: contents, organization, methodologies to be used, schedule and evaluation system. Emphasis is placed on student participation and the personalized tutoring system.
Lecturing	During the academic course, the teacher exposes the main contents of the course, encouraging the active participation of the students. Exercises and type problems are solved, and hands on science methodology will be also applied.
Laboratory practical	Activities for the practical application of the knowledge acquired in the theoretical sessions. They are performed in the laboratory with specialized equipment and in accordance with applicable standards
Autonomous problem solving	Throughout the course, students will be offered different set of problems and questions that they will have to solve by themselves, demonstrating the capacity for learning and developing autonomous work.
Mentored work	The teacher will propose various assignments to be carried out in small groups. Throughout its development the teacher will guide and orient the students. Finally, the work must be presented in a public session in front of the teacher and all the classmates.

Personalized assistance	
Methodologies	**Description**
Lecturing	The teacher will guide and resolve any doubts that the student may have in relation to the contents explained in the lectures.
Laboratory practical	The laboratory teacher will guide the students in the development of the practical classes, clarifying their doubts and guiding them to achieve the best understanding of the practical classes
Mentored work	During the development of the tasks proposed to be done in small groups, the students will have the guidance and help of the teacher
Tests	**Description**

Problem and/or exercise solving	The students will have the support of the teacher to solve the doubts that can arise in the resolution of the numerical problems proposed in class, as well as those that are offered for their autonomous work.
Report of practices, practicum and external practices	The laboratory teacher will guide the students in the resolution of the questions formulated in the practical classes and will help in the doubts that may arise in the writing of the practical reports.
Self-assessment	The teacher will design the self-assessment tests that the student must take throughout the course, and will guide the students in their completion, solving the technical questions that may arise

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	The attendance and active participation of the student in the practical sessions will be valued	0.5	CG3 CG6	CE9	CT1 CT9 CT10
Problem and/or exercise solving	The knowledges acquired in the practical sessions will be evaluated by means of test questions and problems	16	CG4 CG6	CE9	CT1 CT9 CT10
Presentation	The work carried out in small groups will be evaluated through their public defense. The search for information, the structuring of the work and the clarity of the presentation will be especially taken into account.	8	CG4 CG6	CE9	CT1 CT5 CT10
Report of practices, practicum and external practices	The student must present a report of the practical sessions which will include the results obtained in the mechanical tests as well as the answers to the questions asked.	1.5	CG6	CE9	CT9
Self-assessment	Resolution of proposed online questionnaires, which will consist of true and false questions and multiple choice questions	4	CG3	CE9	CT9 CT10
Objective questions exam	Student learning in this course will be evaluated by means of a written exam, which will consist of short answer questions, test questions and problems similar to those posed during the course.	70	CG3 CG4	CE9	CT1 CT5 CT9 CT10

Other comments on the Evaluation

Continuous assessment: The continuous assessment activities will be carried out during the teaching period and correspond to 30% of the grade.

Final Exam: counts for 70% of the course grade. The exam will be taken on the official date set by the EEI direction.

Requirements to pass the course:

It is necessary to achieve a minimum score of 40% in the final exam, that is 2.8 / 7.

If this minimum is not reached, the course will be considered as not passed and, although the sum of the exam grade and the continuous evaluation is higher than 5, the maximum grade that will be included in the academic records will be 4.5 points.

Renouncing continuous assessment: Students that do not follow the continuous assessment activities, after receiving authorization from the EEI direction, will be evaluated through a final exam on the contents of all the course, covering both lecture and labo contents, counting for 100% of the grade. A minimum mark of 5 (50%) will be required to pass the course.

July exam (2nd Edition): In the July edition, the continuous assessment marks will be also considered (only marks obtained in the current academic year). The characteristics of the exam will be the same as the first edition, and will be taken on the official date set by the EEI direction. Further in the July edition, the student can choose to be evaluated through a final exam on the contents of all the course, covering both lecture and labo contents, counting for 100% of the grade. A minimum mark of 5 (50%) will be required to pass the course. The student must notify the teacher of their choice well in advance.

Extraordinary Call: The extraordinary call exam contents will cover the entire course, including both lecture and labo contents, counting for 100% o the grade. A minimum mark of 5 (50%) will be required to pass the course.

Ethical commitment: Students are expected to carry out their work in accordance with an appropriate ethical behaviour. If the professor detects a behaviour that constitutes academic dishonesty (cheating, plagiarism, use of unauthorized

electronic devices, for example) the student will be deemed not to meet all the criteria to pass the course, and will be informed that the final grade of this course will be FAIL (0.0). The use of any electronic device will not be allowed during the evaluation tests, unless expressly authorized. Introducing an unauthorized electronic device into the exam room will be considered reason enough for not passing the course in the present academic year, and the final grade will be: FAIL (0.0).

Attention: If there is any mismatch between the contents of the 3 language versions of this teaching guide, those included in the Spanish version will be considered valid.

Sources of information

Basic Bibliography

Callister, William, **Ciencia e ingeniería de los materiales**, 978-84-291-7251-5, 2ª, Reverté, 2016

Askeland, Donald R, **Ciencia e ingeniería de materiales**, 978-607-481-620-4, 6ª, Cengage Learning, 2012

Shackelford, James F, **Introducción a la ciencia de materiales para ingenieros**, 9788483226599, 7ª, Pearson Educación, 2010

Complementary Bibliography

Smith, William F, **Fundamentos de la ciencia e ingeniería de materiales**, 978-607-15-1152-2, 5ª, McGraw-Hill, 2010

AENOR, **Standard tests**,

Montes J.M., Cuevas F.G., Cintas J., **Ciencia e ingeniería de los materiales / J.M. Montes, F.G. Cuevas, J. Cintas**, 978-84-283-3017-6, 1ª, Paraninfo, 2014

Recommendations

Subjects that continue the syllabus

Materials engineering/V12G380V01504

Subjects that are recommended to be taken simultaneously

Fundamentals of manufacturing systems and technologies/V12G380V01305
Fluid mechanics/V12G380V01405
Thermodynamics and heat transfer/V12G380V01302

Subjects that it is recommended to have taken before

Computer science: Computing for engineering/V12G350V01203
Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Mathematics: Algebra and statistics/V12G380V01103
Mathematics: Calculus I/V12G380V01104
Chemistry: Chemistry/V12G380V01205

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.
* Non-face-to-face student attention (tutoring)
Non-face-to-face tutorial services will be held through the virtual offices on the Online Campus, although the attention of the students may be carried out also by other ways (email, videoconference, Moovi forums, ...), always after previous agreement with the teacher.
* Modifications (if applicable) of the contents of the course
According to the moment when the University decision of starting non-face-to face or mix teaching is made, some reduction of the lab contents will need to be done, following the defined organization. Students will be informed of the changes

through Moovi platform.
* Additional bibliography to facilitate self-learning
If student access to academic libraries is limited, additional documentation will be provided.

* Other modifications

=== ADAPTATION OF THE COURSE ASSESSMENT ===

* 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. Exams will be held face-to-face if possible and will be adapted to take place fully online, if the applied contingency measures make it necessary.
* Tests that are modified
- Final exam: The final exam weight (70% of the course grade) can be modified depending on the date when the non face-to-face teaching is stablished. It can be reduced to a minimum contribution of 40% of the course grade.
- Students will be informed through Moovi of the change in the reweighting of the final exam, as well as the new tests that will be proposed to increase the weight of the continuous assessment.
- The final exam will be held face-to-face if possible but, if not, it will be adapted to be performed online.
* New tests
- In case of reducing the weight of the final exam mark in the course grade, new online tests and/or exercises will be proposed covering different items of the course syllabus and performed online using Moovi platform. The sum of the marks for the new tests and the final exam will contribute 70% to the course grade.
- Students will receive sufficient information in advance of the new tests and the grading procedure through Moovi platform.

IDENTIFYING DATA

Basics of circuit analysis and electrical machines

Subject	Basics of circuit analysis and electrical machines			
Code	V12G360V01302			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language				
Department				
Coordinator	González Estévez, Emilio José Antonio			
Lecturers	González Estévez, Emilio José Antonio			
E-mail	emilio@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Os obxectivos que se perseguen nesta materia son: - Descrición e análise dos elementos dos circuítos eléctricos. - Resolución de circuítos en réxime *estacionario *sinusoidal. - Análise sistemática de circuítos eléctricos. - Conceptos de potencia e enerxía así como a súa determinación. - Análise de circuítos a partir de *teoremas. - Fenómenos nos que se basea a conversión electromagnética de enerxía. - Aspectos xerais comúns e tecnolóxicos das máquinas eléctricas.			

Competencies

Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE10	CE10 Knowledge and use of the principles of circuit theory and electrical machines.
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT10	CT10 Self learning and work.
CT14	CT14 Creativity.
CT17	CT17 Working as a team.

Learning outcomes

Learning outcomes	Competences		
Comprise the basic appearances of the operation of the circuits and the electrical machines	CG3	CE10	CT10 CT17
Know the experimental process used when it works with electrical circuits and scheme electrical.		CE10	
Know the available current technicians for the analysis of electrical circuits	CG3		CT2 CT6
Know the technicians of measure of the electrical circuits		CE10	CT2 CT17
Purchase skills on the process of analysis of electrical circuits	CG3		CT2 CT14

Contents

Topic	
SUBJECT 1. INTRODUCTION And AXIOMS	1.1 Magnitudes and units. 1.2 References of polarity. 1.3 Concept of electrical circuit. 1.4 Axioms of Kirchhoff.

SUBJECT 2. ANALYSIS OF LINEAR CIRCUITS RESISTIVES	2.1 Ideal Elements: definition, representation and mathematical model. 2.2 Models of real sources. 2.3 Equivalent Dipoles: conversion of sources. 2.4 Association of resistors: concept of voltage divider and current divider. 2.5 Association of sources and resistors. 2.6 Topological Concepts: knot, branch, bow and mesh. 2.7 Number and election of circular and nodal equations linearly independent. 2.8 Analyses by meshes and knots of circuits with resistors. 2.9 Topological Transformations. 2.10 Power and energy in resistors, ideal sources and real sources. 2.11 Fundamental theorems.
SUBJECT 3. ANALYSIS OF CIRCUITS WITH ELEMENTS THAT STORE ENERGY	3.1 ideal Condenser: definition, representation and mathematical model. 3.2 magnetic Circuits: units, magnetic flow, strength magnetomotive and reluctance. 3.3 ideal Coil: definition, representation and mathematical model. 3.4 Association series and parallel of coils and capacitors. 3.5 Circuits with elements that store energy. Circuits RL, RC and RLC.
SUBJECT 4. ANALYSIS OF CIRCUITS IN *SINUSOIDAL STEADY-STATE REGIME	4.1 Forms of periodic wave and values associated: sinusoidal wave. 4.2 Determination of the sinusoidal steady-state regime. 4.3 Response of the basic passive elements to sinusoidal excitations: concept of impedance and complex admittance. 4.4 Law of Ohm and axioms of Kirchhoff in sinusoidal steady-state regime. 4.5 Association of elements. 4.6 Analyses by knots and by meshes of circuits in sinusoidal steady-state regime. 4.7 Power and energy in sinusoidal steady-state regime. Instantaneous power, half or active power and energy in the passive elements: coils, capacitors, resistances and complex impedances. 4.8 Power and energy in the dipoles. Apparent power, reactive power and complex power. 4.9 Theorem of conservation of the complex power (theorem of Boucherot). 4.10 The power factor and his importance in the electrical systems. Correction of the power factor. 4.11 Measurement of the active and reactive power: wattmeters and varmeters. 4.12 Fundamental Theorems in sinusoidal steady-state regime.
SUBJECT 5: MAGNETIC ADJUSTMENTS	5.1 Magnetic joined up coils: definitions, equations of flows, own and mutual inductances. Representations and mathematical models. 5.2 Analyses by meshes of circuits of alternating current with coils joined up.
SUBJECT 6: BALANCED THREE-PHASE SYSTEMS	6.1 Introduction. Three-phase voltage system. Sequence of phases. 6.2 Generators and three-phase loads: star and triangle connections. Voltages and currents. 6.3 Equivalent transformations star-triangle. 6.4 Analyses of balanced three-phase systems. Equivalent single-phase circuit. 6.5 Power in balanced three-phase systems. Compensation of the power factor.
SUBJECT 7. ELECTRICAL MACHINES	7.1 Transformer and autotransformers. 7.2 Rotational electrical machines: synchronous machine, asynchronous machine and DC machines.
PRACTICES	1. Use of lab equipments. 2. Measures in resistive circuits. 3. Introduction to the analysis and simulation of circuits by means of Matlab. 4. Determination of a linear model of a real coil with core of air. Real coil with core of iron. Cycle of magnetic hysteresis. 5. Simulation of transient regime by means of Matlab. 6. Measures of active and reactive power in monophase systems. Compensation of the power factor.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	10	30
Problem solving	10	10	20

Autonomous problem solving	0	20	20
Lecturing	22	44	66
Essay questions exam	4	0	4
Report of practices, practicum and external practices	0	10	10

*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	It will be performed circuit assembly corresponding to the knowledges acquired in class of theory, or it will be seen in the laboratory complementary aspects not treated in the theoretical classes.
Problem solving	It will solved type problems and exercises in class of big groups and the student will have to solve similar exercises.
Autonomous problem solving	The student will have to solve on his own a series of exercises and questions of the matter proposed by the professor.
Lecturing	The professor will explain in the classes of big groups the contents of the matter.

Personalized assistance

Methodologies	Description
Problem solving	The professor will attend personally the doubts and queries of the students during the tutorial hours.
Laboratory practical	The professor will attend personally the doubts and queries of the students during the tutorial hours.

Assessment

	Description	Qualification	Evaluated Competencess
Essay questions exam	They will realise a 'written final exam' that will cover the full contents of the subject.	80	CG3 CE10 CT2 CT10 CT14
Report of practices, practicum and external practices	It will be valued positively the realisation of a memory of each one of the practices of laboratory that will include: objectives, procedure followed, materials employed, results obtained and interpretation of them. The realisation of practices and the presentation of the memories are part of the process of continuous evaluation of the student. However, the students that have not realised the practices along the course, or wish to improve the mark obtained, will be able to opt to realise an additional written exam with questions regarding the development of the practices and to the educational contents explained during them. The value of this exam is the 20% of the final mark, in the same way as the continuous evaluation.	20	CE10 CT2 CT6 CT10 CT14 CT17

Other comments on the Evaluation

For the second opportunity of June-July it is kept the qualification in the continuous evaluation obtained during the own course, without prejudice that, to the equal that at the earliest opportunity of December - January,can be surpassed by the realisation of the written exam additional that is proposed to this effect.

Each new enrolment in the subject supposes to put a zero the qualifications in the activities of continuous evaluation obtained in previous courses.

Ethical commitment:

It expects that the student presents a suitable ethical behaviour. In the case to detect a no ethical behaviour (copy, plagiarism,utilisation of unauthorised electronic devices, for example) it will be considered the student does not gather the necessary requirements to surpass the matter. In this case the global qualification in the present academic course will be of suspense (0.0).

It will not be allowed the utilisation of any electronic device during the proofs of evaluation except with explicit permission. The fact to enter an unauthorised electronic device in the classroom of examination will be considered reason of no surpass the matter in the current academic course and the global qualification will be of suspense (0.0).

Responsible professor by group:

Groups

T1 and T2 (theory and practise): EMILIO GONZALEZ ESTÉVEZ

T1 english (theory and practise): DANIEL VILLANUEVA TORRES

Sources of information

Basic Bibliography

A. Bruce Carson, **Teoría de Circuitos**, Thomson Editores, S.A.,

A. Pastor, J. Ortega, V. Parra y A. Pérez, **Circuitos Eléctricos**, Universidad Nacional de Educación a Distancia.,

Suarez Creo, J. y Miranda Blanco, B.N., **Máquinas Eléctricas. Funcionamiento en régimen permanente**, 4ª Edición. Editorial Tórculo.,

Jesus Fraile Mora, **Circuitos eléctricos**, Pearson,

E. González, C. Garrido y J. Cidrás, **Ejercicios resueltos de circuitos eléctricos.**, Editorial Tórculo,

Complementary Bibliography

Recommendations

Other comments

It is very recommended that the students have sufficient knowledge of the algebra of the complex numbers, linear algebra, linear differential equations and have attended to the subject of Physics along the whole first course.
Requirements: To enrol in this matter it is necessary to have surpassed or be enrolled of all the matters of the inferior courses to the course in which it is situated this matter.

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of it uncertain and unpredictable evolution of the sanitary alert caused by the COVID- 19, the University establishes join extraordinary planning that will actuate 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 scenario non-presencial or no totally presencial. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a way but easy and effective when being known beforehand (or with a wide advance) by the students and the teaching staff through the tool normalized and institutionalized of the teaching guides DOCNET.
=== ADAPTATION OF THE METHODOLOGIES ===
In the case of teaching non-presencial or no totally presencial, the impartition of the theory will do through videoconference, employing, several ways of communication during them, the platform Remote Campus. The teaching methodologies will fit to the telematic means commented, employing the cameras, the chat and the presentation of documents for the communication with the students. The documentation used, and another complementary, will be put at the disposal of the students through faitic. Doubts will be solved through the email.
* Teaching methodologies that keep
See above.
* Teaching methodologies that modify
See above.
* Mechanism non-presencial of attention to the students (tutorials)
In the case of the tutorials there will be three possibilities. For simple doubts will employ the email. In the case of doubts of higher scales will be able to use to the videoconferences through remote campus and, in the case that these options are not considered valid, will develop of presencial way, always that it was possible to guarantee the sanitary measures.
* Modifications (proceed) of the contained to impart
Do not proceed
* Additional Bibliography to facilitate the learning
Do not proceed
* Other modifications
As regards the practices, will be able to be realized of way non-presencial employing the same means that uses the theoretical teaching, moreover, to use applications of electric circuits, easily downloaded and manageable by the students. Also it will employ, if it will be necessary and in order to supplement to the practices, some video of the laboratory.
=== ADAPTATION OF THE EVALUATION ===
The only change in the case that no could realize the final examination of presencial way, would be that this would realize employing the remote Campus, faitic and/or other platforms put the disposal of the teaching staff.
In the case that the practices non performed in a presencial way, its evaluation would not suffer changes, except the procedure of delivery, that would be through any of the platforms put the disposal of the teaching staff.
* Proofs already realized
Do not proceed
* pending Proofs that keep
Do not proceed.
* Proofs that modify

Do not proceed.
* New proofs
Do not proceed.
* Additional information
Keep the criteria of evaluation suitable to the realization of the proofs, in the case to be necessary and by indication in a Resolución Reitoral, to the telematic means places at the disposal of the teaching staff.

In general, this plan of contingencies will be applied only to be necessary and, in the possible case, it will just take into account the compulsory changes, leaving the rest of circumstances without afectation.

IDENTIFYING DATA				
Teoría de máquinas e mecanismos				
Subject	Teoría de máquinas e mecanismos			
Code	V12G360V01303			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Yáñez Alfonso, Pablo			
Lecturers	Fernández Álvarez, José Manuel Yáñez Alfonso, Pablo			
E-mail	pyanez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Esta materia proporcionará ao alumno coñecementos dos fundamentos básicos da Teoría de Máquinas e Mecanismos e a súa aplicación no campo da enxeñaría Mecánica. Achegaralle coñecementos sobre os conceptos máis importantes relacionados coa teoría máquinas e mecanismos. Coñecerá e aplicará as técnicas de análises *cinemático e dinámico para sistemas mecánicos, tanto gráficas e analítica, como mediante a utilización eficaz de software de simulación. Así mesmo servirá de introdución a aspectos sobre maquinaria que abordará en materias de cursos posteriores da Titulación.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE13	CE13 Coñecemento dos principios de teoría de máquinas e mecanismos.
CT2	CT2 Resolución de problemas.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.
CT10	CT10 Aprendizaxe e traballo autónomos.
CT16	CT16 Razoamento crítico.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecer os fundamentos básicos da Teoría de Máquinas e Mecanismos e a súa aplicación na Enxeñaría Mecánica para resolver os problemas relacionados coa devandita materia no campo da Enxeñaría Industrial. Coñecer, comprender, aplicar e practicar os conceptos relacionados coa Teoría de Máquina e Mecanismos Coñecer e aplicar as técnicas análises *cinemático e dinámico de sistemas mecánicos. Coñecer e utilizar eficazmente software de análise de mecanismos.	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16

Contidos	
Topic	
Introdución á Teoría de *maquinas e mecanismos.	Introdución. Definición de máquina, mecanismo e cadea *cinemática. Membros e pares *cinemáticos. Clasificación. *Esquematización, modelización e simboloxía. Mobilidade. Graos de liberdade. Síntese de mecanismos.
Análise xeométrica de mecanismos.	Introdución. Métodos de cálculo da posición. Ecuacións de peche de circuíto.

Análise *cinemático de mecanismos.	Fundamentos. Métodos gráficos. Métodos analíticos. Métodos *matriciales.
Análise estática de mecanismos.	Fundamentos. Redución de forzas. Método dos traballos/potencias virtuais.
Análise dinámica de mecanismos.	Fundamentos. Dinámica xeral de máquinas. Traballo e potencia en máquinas. Dinámica do equilibrado.
Mecanismos de *Leva.	Fundamentos xerais. *Levas Planas. Síntese de *levas.
Mecanismos de transmisión.	Fundamentos. Mecanismo de engrenaxes. Outros mecanismos.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	23	19.5	42.5
Resolución de problemas	9.5	30	39.5
Prácticas de laboratorio	18	47	65
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	Clase maxistral na que expoñen os contidos teóricos.
Resolución de problemas	Resolución de problemas utilizando os conceptos teóricos presentados en aula.
Prácticas de laboratorio	Realización de tarefas prácticas en laboratorio docente ou aula informática

Atención personalizada

Methodologies	Description
Lección maxistral	
Resolución de problemas	
Prácticas de laboratorio	

Avaliación

	Description	Qualification	Evaluated Competencess		
Prácticas de laboratorio	Valorarase a asistencia e a participación do alumno nas prácticas de laboratorio e as memorias de práctica	20	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16
Exame de preguntas de desenvolvemento	Exame final/parciais enfocados aos contidos correspondentes impartidos durante as clases de aula e laboratorio	80	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16

Other comments on the Evaluation

A materia aprobase si se obtén unha cualificación igual ou maior que un 5 como nota final, da seguinte forma:

- Prácticas de laboratorio.
    - A asistencia con aproveitamento ao Laboratorio/Aula informática, a cualificación das memorias entregadas en cada práctica e os traballos tutelados, terán unha valoración máxima de 2 puntos da nota final, esta cualificación conservarase na segunda edición da convocatoria. Para poder ser avaliado neste apartado o alumno deberá asistir a un mínimo de 7 prácticas.

- Para os alumnos que soliciten renuncia á avaliación continua e a teñan oficialmente aceptada, existirá un exame final de Laboratorio cunha valoración máxima de 2 puntos. Se o alumno desexa realizar dita proba, debe avisar ao profesor antes do exame para que o profesor prepare o material necesario.

- Exame de preguntas de desenvolvemento. Terá unha valoración mínima de 8 puntos da nota final.

* Empregarase un sistema de cualificación numérica de 0 a 10 puntos segundo a lexislación vixente (RD 1125/2003 de 5 de setembro, BOE de 18 de setembro).

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0.0).

Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula do exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0.0).

Bibliografía. Fontes de información

Basic Bibliography

Munir Khamashta, **Problemas resueltos de cinemática de mecanismos planos**, UPC,

Munir Khamashta, **Problemas resueltos de dinámica de mecanismos planos**, UPC,

Calero Pérez, R. y Carta González, J.A., **Fundamentos de mecanismos y máquinas para ingenieros**, McGraw-Hill,

Complementary Bibliography

García Prada, J.C. Castejón, C., Rubio, H., **Problemas resueltos de Teoría de Máquinas y mecanismos**, THOMSON,

Cardona, S. y Clos D., **Teoría de Máquinas.**, UPC,

Shigley, J.E.; Uicker J.J. Jr., **Teoría de Máquinas y Mecanismos**, McGraw-Hill,

Hernández A, **Cinemática de mecanismos: Análisis y diseño**, SÍNTESIS,

Lamadrid Martínez, A.; Corral Sáiz, A., **Cinemática y Dinámica de Máquinas**, E.T.S.I.I.T,

Mabie, Reinholtz, **Mecanismos y dinámica de maquinaria**, Limusa-wyley,

Nieto, j., **Síntesis de Mecanismos**, AC,

Erdman, A.G.; Sandor, G.N.,, **Diseño de Mecanismos Análisis y síntesis**, PRENTICE HALL,

Simon A.; Bataller A; Guerra .J.; Ortiz, A.; Cabrera, J.A., **Fundamentos de teoría de Máquinas**, BELLISCO,

Kozhevnikov SN, **Mecanismos**, Gustavo Gili,

Recomendacións

Subjects that continue the syllabus

Deseño e ensaio de máquinas/V12G360V01602

Subjects that it is recommended to have taken before

Expresión gráfica: Expresión gráfica/V12G380V01101
Física: Física I/V12G380V01102
Matemáticas: Álxebra e estatística/V12G380V01103
Matemáticas: Cálculo I/V12G380V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G380V01204

Other comments

Requisitos: Para matricularse nesta materia é necesario superar ou ben estar matriculado de todas as materias do primeiro curso.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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.
No caso de que a asistencia presencial do alumnado ás clases estea legalmente limitada total ou parcialmente, adoptaranse as seguintes medidas:
1 Garantir que o alumnado matriculado teña disposición dos medios necesarios para o seguimento adecuado da docencia non presencial, que serán: computador persoal e acceso a internet. O alumnado que non dispoña dalgún deses medios deberá comunicalo ao coordinador da materia para solucionalo.
2 Emprégase a plataforma Faitic da materia para a comunicación ao alumnado das distintas medidas adoptadas.
3 Respecto a a presente guía docente, modifícase en caso de non presencialidade segundo:
A: Competencias: Non se modifican.
B: Resultados de aprendizaxe: Non se modifican.
C: Contidos: Non se modifican.
D: Planificación: Non se modifica.
E: Metodoloxías: Modifícanse segundo:
Lección maxistral e resolución de problemas: impartirase empregando medios telemáticos (aula virtual do Campus Remoto ou outros)
Prácticas de laboratorio: Darase acceso ao alumnado a software de simulación dinámica para que poida realizar as prácticas desde fóra do laboratorio de Enxeñería Mecánica. Estas prácticas serán tuteladas empregando medios telemáticos (aula virtual do Campus Remoto ou outros)
F: Atención personalizada: As sesións de tutorización poderán realizarse por medios telemáticos baixo a modalidade de concertación previa.
G: Avaliación: Non se modifican as metodoloxías/probas: Prácticas de laboratorio e Exame de preguntas de desenvolvemento. Non se modifica a súa descrición, o peso da súa cualificación nin as competencias avaliadas. As probas realizaranse empregando medios telemáticos (aula virtual do Campus Remoto ou outros), as normas concretas de cada proba publicaranse con antelación en Faitic. A asistencia ás prácticas será contabilizada en función da asistencia virtual do alumnado a cada práctica.
Poderanse facer probas parciais para a avaliación de contidos concretos da asignatura. As condicións particulares destas probas publicaranse con antelación a través da plataforma FAITIC.
H: Bibliografía. Fontes de información: Aparte das referencias bibliográficas da presente guía, da documentación facilitada en Faitic con boletíns de problemas e exames de cursos anteriores, poderase facilitar documentación adicional (apuntamentos, vídeos, referencias web,) para que o alumnado sen asistencia presencial poida seguir adecuadamente a materia.
A presente guía poderá ser modificada atendendo a resolucións reitorais ao respecto.

IDENTIFYING DATA				
Automation and control fundamentals				
Subject	Automation and control fundamentals			
Code	V12G360V01304			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Espada Seoane, Angel Manuel			
Lecturers	Espada Seoane, Angel Manuel Fernández Silva, María			
E-mail	aespada@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	In this matter present the basic concepts of the systems of industrial automation and of the methods of control, considering like central elements of the same the programmable programmable logic controller and the industrial controller, respectively.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE12	CE12 Know the fundamentals of automation and control methods.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Apply knowledge.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes	Competences		
Purchase a global and realistic vision of the current scope of industrial automation systems.	CG3	CE12	CT17 CT20
Know which are the constitutive elements of an industrial automation system, its sizing and as they work.	CG3	CE12	CT2 CT6 CT20
Knowledge applied on the programmable logic controllers, its programming and its application to industrial automation systems.	CG3	CE12	CT2 CT6 CT9 CT16 CT17
General knowledge on the continuous control of dynamic systems, of the main tools of simulation of continuous systems and of the main devices of process control with greater interest to industrial level.	CG3	CE12	CT3 CT6 CT17 CT20
General concepts of the technicians of industrial controllers tuning.	CG3	CE12	CT2 CT9 CT16

Contents	
Topic	
1. Introducción to industrial automation and elements of automation.	1.1 Introducción to automation of tasks. 1.2 Types of control. 1.3 The programmable logic controller. 1.4 Diagrama of blocks. Elements of the PLC. 1.5 Cycle of operation of the PLC. Time of cycle. 1.6 Ways of operation.

2. Languages and programming technics of programmable logic controllers.	2.1 Binary, octal, hexadecimal, BCD systems. Real numbers. 2.2 Access and adressing to periphery. 2.3 Instructions, variables and operating. 2.4 Forms of representation of a program. 2.5 Types of modules of program. 2.6 linear Programming and estructurada. 2.7 Variables binarias. Entrances, exits and memory. 2.8 Binary combinations. 2.9 Operations of allocation. 2.10 Timers and counters. 2.11 Operations aritméticas.
3. Tools for sequential systems modelling.	3.1 Basic principles. Modelling technics. 3.2 Modelling by means of Petri Networks. 3.2.1 Definition of stages and transitions. Rules of evolution. 3.2.2 Conditional election between several alternatives. 3.2.3 Simultaneous sequences. Concurrence. Resource shared. 3.3 Implementation of Petri Networks. 3.3.1 Direct implementation. 3.3.2 Normalised implementation (Grafcet). 3.4 Examples.
4. Control systems introduction.	4.1 Systems of regulation in open loop and closed loop. 4.2 Control typical loop. Nomenclature and definitions.
5. Representation, modelling and simulation of continuous dynamic systems.	5.1 Physical systems and mathematical models. 5.2.1 Mechanical systems. 5.2.2 Electrical systems. 5.2.3 Others. 5.3 Modelling in state space. 5.4 Modelling in transfer function. Laplace transform. Properties. Examples. 5.5 Blocks diagrams.
6. Analysis of continous dynamical systems.	6.1 Stability. 6.2 Transient response. 6.2.1 First order systems. Differential equation and transfer function. Examples. 6.2.2 Second order systems. Differential equation and transfer function. Examples. 6.2.3 Effect of the addition of poles and zeros. 6.3 Systems reduction. 6.4 Steady-state response. 6.4.1 Steady-state errors. 6.4.2 Input signals and system type. 6.4.3 Error constants.
7. PID controller. Parameters tunning of industrial controllers.	7.1 Basic control actions. Proportional effects, integral and derivative. 7.2 PID controller. 7.3 Empirical methods of tuning of industrial controllers. 7.3.1 Open loop tuning: Ziegler-Nichols and others. 7.3.2 Closed loop tuning: Ziegler-Nichols and others. 7.4 Controllers design state space. Pole assigment.
P1. Introduction to STEP7.	Introduction to the program STEP7, that allows to create and modify programs for the Siemens PLC S7-300 and S7-400.
P2. Programming in STEP7.	Modelling of simple automation system and implementation in STEP7 using binary operations.
P3. Implementation of PN in STEP7.	Petri Networks modelling of simple automation system and introduction to the implementation of the same in STEP7.
P4. PN Modelling and implementation in STEP7.	Petri Networks modelling of complex automation system and implementation of the same in STEP7.
P5. GRAFCET modelling and implementation with S7-Graph.	Petri Networks normalised modelling and implementation with S7-Graph.
P6. Control systems analysis with MATLAB.	Introduction to the control systems instructions of the program MATLAB.
P7. Introduction to SIMULINK.	Introduction to SIMULINK program, an extension of MATLAB for dynamic systems simulation.
P8. Modelling and transient response in SIMULINK.	Modelling and simulation of control systems with SIMULINK.
P9. Empirical tuning of an industrial controller.	Parameters tuning of a PID controller by the methods studied and implementation of the control calculated in an industrial controller.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	30	48
Problem solving	0	15	15
Lecturing	32.5	32.5	65
Essay questions exam	3	19	22

*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	Different activities aimed to apply the concepts learned during the lectures.
Problem solving	The professor is going to solve in class some problems and exercises. The students need to solve similar exercises on their own to obtain the capabilities needed.
Lecturing	Include the professor lectures about the contents of the subject.

Personalized assistance

Methodologies	Description
Lecturing	For a effective use of the dedication of the student body, the faculty will attend personally the doubts and queries of the same. Said attention will take place so much in the classes of theory, problems and laboratory as in the tutorials (in a schedule prefixed). For all teaching modalities, the tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Laboratory practical	For a effective use of the dedication of the student body, the faculty will attend personally the doubts and queries of the same. Said attention will take place so much in the classes of theory, problems and laboratory as in the tutorials (in a schedule prefixed). For all teaching modalities, the tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Problem solving	For a effective use of the dedication of the student body, the faculty will attend personally the doubts and queries of the same. Said attention will take place so much in the classes of theory, problems and laboratory as in the tutorials (in a schedule prefixed). For all teaching modalities, the tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.
Tests	**Description**
Essay questions exam	For a effective use of the dedication of the student body, the faculty will attend personally the doubts and queries of the same. Said attention will take place so much in the classes of theory, problems and laboratory as in the tutorials (in a schedule prefixed). For all teaching modalities, the tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	It will evaluate each practice of laboratory between 0 and 10 points, in function of the fulfillment of the aims fixed in the billed of the same and of the previous preparation and the attitude of the students. Each practical will be able to have distinct weight in the total note.	20	CG3	CE12	CT3 CT6 CT9 CT16 CT17 CT20
Essay questions exam	Final examination of the contents of the matter, that will be able to include problems and exercises, with a punctuation between 0 and 10 points.	80	CG3	CE12	CT2 CT3 CT16

Other comments on the Evaluation

- Continous Assesment of student work practices along established laboratory sessions will be held in the semester, with the assistance to them mandatory. In the case of not overcome, a review of practices, conditioned to having passed the script test, will take place in the second call, on a date after the script test, in one or more sessions and including the contents not passed in ordinary practice sessions.
- The assesment of the practices for students who officially renounces Continuous Assesment will be carried out in a review of practices, conditioned to having passed the script test, in the two calls, on a date after the script test, in one or more sessions and including the same contents of the ordinary practice sessions..
- It may demand previous requirements to the realisation of each practice in the laboratory, so that they limit the maximum qualification to obtain.
- It must pass both tests (script and practices) to pass the matter, give the total score at the rate indicated above. In case of

no longer than two or one test, scaling may be applied to partial notes that the total does not exceed 4.5.
- In the final exam may establish a minimum score on a set of issues to overcome.
- In the second call of the the same course, students should examine the tests (script and/or practices) not passed in the first one, with the same criteria of that.
- According to the Rule of Continuous Assesment, the subject students to Continuous Assesment that present to some activity evaluable collected in the Teaching Guide of the matter, will be considered like "presented".
- Ethical commitment: student is expected to present an adequate ethical behavior. If you detect unethical behavior (copying, plagiarism, unauthorized use of electronic devices, and another ones), it follows that the student does not meet the requirements for passing the subject. In this case the global qualification in the present academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

E.MANDADO, J.MARCOS, C. FERNANDEZ, J.I.ARMESTO, **Autómatas Programables y Sistemas de Automatización**, 1ª, Marcombo, 2009

MANUEL SILVA, **Las Redes de Petri en la Automática y la Informática**, 1ª, AC, 1985

R. C. DORF, R. H. BISHOP, **Sistemas de Control Moderno**, 10ª, Prentice Hall, 2005

Complementary Bibliography

PORRAS A., MONTANERO A., **Autómatas programables : fundamento, manejo, instalación y prácticas**, McGraw-Hill, 2003

ROMERA J.P., LORITE J.A., MONTORO S., **Automatización : problemas resueltos con autómatas programables**, 4ª, Paraninfo, 2002

BARRIENTOS, ANTONIO, **Control de sistemas continuos: Problemas resueltos**, 1ª, McGraw-Hill, 1997

OGATA, KATSUIKO, **Ingeniería de Control Moderna**, 5ª, Pearson, 2010

Recommendations

Subjects that continue the syllabus

Product design and communication, and automation of plant elements/V12G380V01931

Subjects that are recommended to be taken simultaneously

Electronic technology/V12G380V01404

Subjects that it is recommended to have taken before

Computer science: Computing for engineering/V12G380V01203
Mathematics: Calculus II and differential equations/V12G380V01204
Fundamentals of electrical engineering/V12G380V01303

Other comments

- Requirements: To enrol in this subject is necessary to had surpassed or well be enrolled of all the subjects of the inferior courses to the course in the that is summoned this subject.

Contingency plan

Description

Considering the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University establishes an extraordinary planning that will be activated when the administrations and the institution determine it. It is based on safety, health and responsibility, and it guarantees teaching in an online or semi-presential modalities. These already planned measures will guarantee, at the required time, the development of teaching in a more agile and effective way, because they will be known in advance by students and teachers through the standardized tool for teaching guides DOCNET

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching Methodologies that keep

- Lecturing.
- Problem solving.
- Laboratory practices without use of instrumentation.

* Teaching methodologies that modify

- Laboratory practices with use of instrumentation: will be replaced by activities in virtualized environments.

* Adaptation of tutorial sessions and personalized attention

The tutorial sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) with prior agreement.

=== ADAPTATION OF THE EVALUATION ===

Keep the type of proofs and his weighting in the final qualification, adapting his realization to the circumstances.

IDENTIFYING DATA				
Fundamentos de organización de empresas				
Subject	Fundamentos de organización de empresas			
Code	V12G360V01305			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Organización de empresas e márketing			
Coordinator	Doiro Sancho, Manuel			
Lecturers	Doiro Sancho, Manuel Lozano Lozano, Luis Manuel Mejías Sacaluga, Ana María Sartal Rodríguez, Antonio			
E-mail	mdoiro@uvigo.es			
Web				
General description				

Competencias	
Code	
CG8	CG8 Capacidade para aplicar os principios e métodos da calidade.
CG9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
CE15	CE15 Coñecementos básicos dos sistemas de produción e fabricación.
CE17	CE17 Coñecementos aplicados de organización de empresas.
CT1	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT7	CT7 Capacidade de organizar e planificar.
CT8	CT8 Toma de decisións.
CT9	CT9 Aplicar coñecementos.
CT11	CT11 Capacidade para comprender o significado e aplicación da perspectiva de xénero nos distintos ámbitos de coñecemento e na práctica profesional co obxectivo de alcanzar unha sociedade máis xusta e igualitaria.
CT18	CT18 Traballo nun contexto internacional.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecer a base sobre a que se apoian as actividades relacionadas con a Organización e a Xestión de a Produción.	CG8 CG9	CE15 CE17	CT1 CT2
Coñecer o alcance de as distintas actividades relacionadas con a produción.			CT7
Adquirir unha visión de conxunto para a ejecución de as actividades relacionadas con a organización e xestión de a produción.			CT8 CT9
Realizar unha valoración de os postos de traballo desde un enfoque que axude a o desenvolvemento de as persoas con unha perspectiva de eficiencia e igualdade			CT11 CT18

Contidos	
Topic	
PARTE I. CONTORNA ACTUAL E SISTEMAS PRODUTIVOS	1.CONTORNA ACTUAL DE A EMPRESA.Os SISTEMAS PRODUTIVOS
PARTE II. PREVISIÓN DE A DEMANDA	2. INTRODUCIÓN. COMPOÑENTES. MÉTODOS DE PREVISIÓN DE A DEMANDA: CUANTITATIVOS E CUALITATIVOS
PARTE III. XESTIÓN DE INVENTARIOS E XESTIÓN DE PRODUCIÓN	3.CONCEPTOS BÁSICOS DE Os INVENTARIOS. CONTROL DE INVENTARIOS 4.XESTIÓN DE INVENTARIOS. MODELOS BÁSICOS
PARTE *IV. XESTIÓN DE PRODUCIÓN EN EMPRESAS INDUSTRIAIS	5.PLANIFICACIÓN DE PRODUCIÓN. PLAN AGREGADO. PLAN MESTRE DE PRODUCIÓN 6.PLANIFICACIÓN DE NECESIDADES DE MATERIAIS (*MRP) 7.PLANIFICACIÓN DE CAPACIDADE. PROGRAMACIÓN DE PRODUCIÓN: CRITERIOS E REGRAS BÁSICAS
PARTE *V. INTRODUCIÓN Ao ESTUDO DO TRABALLO	8.INTRODUCIÓN Ao ESTUDO DO TRABALLO. DISTRIBUCIÓN EN PLANTA

PARTE VIN. XESTIÓN LEAN	9.O ENFOQUE LEAN NA XESTIÓN. DEFINICIÓN E OBXECTIVOS. ELEMENTOS LEAN
PARTE *VII. INTRODUCIÓN Á XESTIÓN DA CALIDADE, A SEGURIDADE E O MEDIO AMBIENTE	10. INTRODUCIÓN Á XESTIÓN DA CALIDADE, A SEGURIDADE E O MEDIO AMBIENTE
PRÁCTICAS	1. PREVISIÓN DA DEMANDA 2. CONTROL E XESTIÓN DE INVENTARIOS 3. PLANIFICACIÓN DA PRODUCIÓN *I 4. PLANIFICACIÓN DA PRODUCIÓN *II 5. LISTAS DE MATERIAIS E OPERACIÓNS 6. PLANIFICACIÓN DA CAPACIDADE 7. PROGRAMACIÓN DA PRODUCIÓN 8. ESTUDO DO TRABALLO 9. PROBA GLOBAL

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	64.5	97
Prácticas con apoio das TIC	18	18	36
Exame de preguntas obxectivas	6	6	12
Práctica de laboratorio	2	3	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 sobre a materia obxecto de estudo, bases teóricas e/ou directrices do traballo, exercicio ou proxecto a desenvolver polo estudante.
Prácticas con apoio das TIC	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e *procedimentales relacionadas coa materia obxecto de estudo. Desenvólvense en espazos especiais con equipamento adecuado.

Atención personalizada

Methodologies	Description
Lección maxistral	
Prácticas con apoio das TIC	

Avaliación

	Description	Qualification	Evaluated Competencess		
Exame de preguntas obxectivas	2 Teórico-Prácticas: Probas de avaliación continua que se realizarán a o longo do curso, nas clases de teoría, distribuídas de forma uniforme e programadas para que non interfiran no resto das materias. Cada unha destas probas (puntuación sobre 10) constarán dunha parte tipo test (5 puntos) e doutra de exercicios (5 puntos). Para poder superar ou compensar dita proba hai que alcanzar en cada unha das partes polo menos 1,75 puntos	60	CG8 CG9	CE15 CE17	CT1 CT2 CT7 CT8 CT9 CT18
Práctica de laboratorio	1 Práctica de exercicios: Proba de avaliación continua que se realizará en as clases de prácticas.	40	CG8 CG9	CE15 CE17	CT1 CT2 CT7 CT8 CT9 CT18

Other comments on the Evaluation

COMPROMISO ÉTICO Espérase que o alumno presente un comportamento ético adecuado. En o caso de detectar un comportamento non ético (copia, plagio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. En este caso a cualificación global en o presente curso académico será de suspenso (0,0). Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado en o aula de exame será considerado motivo de non superación de a materia en o presente curso académico e a cualificación global será de suspenso (0,0) OUTROS COMENTARIOS En todos os casos, en cada proba (teórico-práctica ou de exercicios) debe alcanzarse un mínimo de 4 puntos para que se poida compensar con o resto de notas. Soamente poderase compensar unha proba

cando o resto de as notas estean por encima de o valor mínimo (4). Aclaración A modo de exemplo, un alumno que teña as seguintes puntuaciones: 4, 4 e 7 compensaría as partes con a nota de 4 e superaría a materia. En o caso de que as notas obtidas fosen 3, 4 e 8 NON compensa a materia e tampouco compensa a proba con a nota de 4 (xa que o resto de as notas non cumpren a condición de o valor mínimo de 4 puntos). En este último caso o alumno tería que ir a Xaneiro/Xuño con a proba reducida ou ampliada, segundo o caso. Sinalar que a a hora de facer a media entre as diferentes partes debe terse en conta a ponderación de as mesmas. AVALIACIÓN CONTINUA (cualificación sobre 10) Para superar a materia por Avaliación Continua deben cumprirse os seguintes puntos: 1. É imprescindible realizar con aprovechamiento as prácticas de a asignatura asistindo a as mesmas e entregando a resolución de os exercicios propostos. Só se permitirán 2 faltas a o longo de todo o curso, debéndose entregar a resolución de as mesmas. O comportamento inadecuado en as clases se penalizará coma se fose unha falta. Unha vez superado o tope de as 2 faltas non se poderá aprobar a materia por avaliación continua. 2. . Débense superar (e/ou compensar) todas as probas (teórico-prácticas e de exercicios). Os alumnos que superen a Avaliación Continua quedarán exentos de as convocatorias oficiais. No entanto, poderán presentarse en o caso de que queiran optar a maior nota. En o caso de superar a Avaliación Continua e presentarse a as convocatorias oficiais, a nota final será a que se obteña como resultado de ambas probas. CONVOCATORIAS OFICIAIS (cualificación sobre 10) Os alumnos que NON superen a avaliación continua e teñan soamente una de as tres probas pendente, poderán recuperar esta únicamente en a convocatoria de Xaneiro/Xuño. En o resto de os casos: a) Aqueles alumnos que desenvolvan con aprovechamiento as prácticas (é dicir, que asistan e entregado as resolución de as mesmas), realizarán unha proba reducida con un parte teórico-práctica (60% de a nota) e outra de exercicios (40% de a nota). b) Aqueles alumnos que non cumpran a condición de as prácticas, realizarán unha proba ampliada con unha parte teórico-práctica (60% de a nota) e outra de exercicios (40% de a nota). Cualificación final. A nota final de o alumno calcularase a partir de as notas de as distintas probas tendo en conta a ponderación de estas (probas tipo test 60% e parte de prácticas 40%). En calquera caso, para superar a materia é condición necesaria superar todas a partes ou ben ter unha media de aprobado sen que ningunha de as notas sexa inferior a o 4 (nota mínima para compensar). En os casos en os que a nota media sexa igual ou superior a o valor de o aprobado pero en algunha de as parte non se alcanzou o valor mínimo de 4, a cualificación final será de suspenso. A modo de exemplo, un alumno que obteña as seguintes cualificacións: 5, 9 e 1 estaría suspenso, aínda cando a nota media dá un valor >=5, a o ter unha de as partes por baixo de a nota de corte (4). En estes casos, a nota que se reflectirá en o acta será de suspenso (4).

Bibliografía. Fontes de información

Basic Bibliography

Chase, R.B y Davis, M.M., **Administración de Operaciones. Producción y cadena de suministros**, McGraw-Hill, 2014

hase, R.B y Davis, M.M., **Administración de Operaciones. Producción y cadena de suministros**, McGraw-Hill, 2014

Krajewski, Ritzman y Malhotra, **Administración de Operaciones. Procesos y cadena de suministro**, Pearson, 2013

Complementary Bibliography

Heizer, J. y Render, B., **Dirección de la Producción y de Operaciones. Decisiones Estratégicas y Tácticas**, Pearson, 2015

Larrañeta, J.C., Onieva, L. y Lozano, S., **Métodos Modernos de gestión de la Producción**, Alianza Editorial, 1995

Schroeder, R.G., **Administración de Operaciones**, McGraw-Hill, 2011

Recomendacións

Other comments

Para matricularse nesta materia é necesario ter superadas ou ben estar matriculado de todas as materias dos cursos inferiores ao curso no que está emprazada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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:

CLASES TEÓRICAS
Utilizaranse os arquivos en formato *pdf das transparencias da materia como documento base para o seguimento da materia. No caso de que algún contido sexa especialmente complicado de comprender ou que suscite numerosas preguntas por parte dos alumnos, incorporarase información adicional (a través dos foros de *Faitic ou mediante a incorporación de documentación complementaria). As clases impartiranse nos horarios habituais, pero a través do campus remoto ou algún outro medio equivalente.

* Metodoloxías docentes que se modifican

CLASES PRÁCTICAS
Proporase a realización dun conxunto de prácticas guiadas que serán enviadas a través de *email/*Faitic ao profesor encargado das prácticas. Para un desenvolvemento adecuado da actividade práctica e poder realizar correctamente os exercicios propostos, é necesario estudar os contidos teóricos correspondentes á temática da práctica. Ademais, para facilitar a realización das prácticas, para cada unha delas mostrarase un práctica tipo resolta, similar á proposta, pero con diferentes datos numéricos/parámetros. Tamén se programarán sesións para resolver dúbidas *online a través do campus remoto.

* Mecanismo non presencial de atención ao alumnado (*tutorías)

Indicaranse franxas horarias para a súa impartición a través do campus remoto e/ou baixo demanda do alumnado previo envío de correo electrónico.

* Modificacións (si proceden) dos contidos a impartir

Non procede

* Bibliografía adicional para facilitar o auto-aprendizaxe

Non procede

* Outras modificacións

Non procede

=== ADAPTACIÓN DA AVALIACIÓN ===
No caso de non poder realizarse as probas de maneira presencial, garántese a mesma estrutura da avaliación presencial (mesmas probas e mesmos pesos). Cando non poidan realizarse de maneira presencial, as probas realizaranse a través dos medios remotos dispoñibles na *UVigo (*Faitic, Campus Remoto,) e estableceranse mecanismos de control adecuados para evitar comportamentos inadecuados que incumpran o código ético establecido pola Universidade de Vigo e a Escola de Enxeñaría Industrial. En calquera caso, garántese que o alumnado poderá superar a materia por avaliación continua sen necesidade de asistir ao exame final oficial recolleito na planificación da Escola.

IDENTIFYING DATA				
Electronic technology				
Subject	Electronic technology			
Code	V12G360V01401			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Mariño Espiñeira, Perfecto			
Lecturers	Mariño Espiñeira, Perfecto Pérez López, Serafín Alfonso Rodríguez Castro, Francisco Verdugo Mates, Rafael			
E-mail	pmarino@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The objective of this course is to provide the students with the theoretical and practical fundamental knowledge in electronics' five main areas: analog electronics, digital electronics, industrial sensors, power electronics and communications electronics. In case of any discrepancy between this translation of the guide and the Spanish version, the valid one is the Spanish version.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE11	CE11 Knowledge of the fundamentals of electronics.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes		Competences	
Know the operation of the electronic devices.	CG3	CE11	CT2 CT9 CT10 CT17
Know the electronic systems of conditioning and acquisition of data.		CE11	CT10
Identify the different types of industrial sensors.			CT10
Know the digital electronic systems basic.		CE11	CT2 CT9 CT17
Know the electronic circuits for the communication of information.	CG3		CT10

Contents	
Topic	
Introduction	- Control and supervision of industrial systems by means of electronics - Some representative cases
Electronic devices, circuits and systems	- Electronics components and devices - Active and passive electronic devices - Analog and digital electronic circuits - Electronic systems

Diodes and rectification	- The diode - Operation modes and characteristics - Diodes types - Operation Models - Analysis of circuits with diodes - Rectifier circuits - Filtering for rectifier circuits - Thyristors
Transistors	- The Bipolar Junction Transistor (BJT.) Operation principles and characteristic curves - Work zones - Quiescent point design - The transistor operating as a switch - The transistor operating as an amplifier - Field Effect Transistors (FET).
Amplification	- Amplification concept - Feedback concept - The Operational Amplifier (OA) - Basic circuits with OA - The Instrumentation Amplifier
Digital Electronics I	- Numbering Systems - Boolean Algebra - Combinatorial logic functions. Analysis, synthesis and reduction
Digital electronics II	- Flip-flops - Sequential logic circuits - Programmable Systems - Microprocessors - Memories
Electronic Sensors	- Sensors - Types of sensors as function of the measuring magnitude - Some sensors of special interest in industry applications - Electrical model of some common sensors - Study of some examples of coupling sensors and CAD system
Analog - Digital Converters	- The Analog and Digital Signals. - The Analog to Digital Converter (ADC) - Sampling, quantification and digitization - More important ADC characteristics: number of bits, sampling speed, conversion range and cost
Industrial Communications	- Introduction to Industrial Communications - Industrial data buses.
Power Electronics	- Circuits for Power Conversion - Rectifiers - Lineal and Switched Power Sources

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	0	25
Problem solving	8	0	8
Previous studies	0	49	49
Autonomous problem solving	0	46	46
Laboratory practical	18	0	18
Objective questions exam	1	0	1
Essay questions exam	3	0	3

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

Methodologies

	Description
Lecturing	These sessions will be held in the rooms and dates fixed by the direction of the school. They will consist in an oral explanation by the professor of the most important parts of the course, all related with the materials that the student had to work previously. This is intended to favor the active participation of the students, that will have occasion to rise doubts and questions during the sessions. Active participation is desired during all the sessions.
Problem solving	During these sessions, in the classroom, interleaved with the lectures, the professor will proceed to solve examples and/or exercises that properly illustrate the problems to solve. As long as the number of participants in the classroom allows, active participation will be promoted.

Previous studies	Previous preparation of the theoretical sessions: Prior to the start of the theoretical sessions, the students will have available a series of materials that have to prepare, as the sessions will relay on them. Previous preparation of the laboratory sessions: It is mandatory that the students make all the assigned previous tasks prior to access the laboratory. These task are intended to greatly improve the laboratory knowledge acquisition. The achieved report will be taken into account when the laboratory session is to be evaluated.
Autonomous problem solving	Self study and review of the theoretical sessions for knowledge consolidation: The student must study, in a systematic time schedule, after each lecture session, in order to dissipate any doubts. Any doubts or unsolved questions will have to be expose to the professor as soon as possible in order to enhance the feedback of the learning process.
Laboratory practical	Laboratory sessions will be held in the time schedule established by the school's head teacher. Students will work in groups of two students each. The sessions will be supervised by a professor, who will control the assistance and will also evaluate the harnessing of it. During the laboratory sessionsthe students will make activities of the following kinds: - Assembling electronics circuits - Use of electronic instrumentation - Measure of physical variables on circuits - Do calculations related to the circuit and/or the measurements - Collect data and represent it (diagrams, charts, tables) At the end of each laboratory session each group will deliver the corresponding score sheets.

Personalized assistance

Methodologies	Description
Laboratory practical	Tutoring Sessions: During the established schedule of each professor, students will be able to speak freely about course issues with the professor. Also the will receive orientation and academic support, if needed. Email: The students also will be able to request orientation and support by means of email to the professors of the course. This way of attention is advisable for indications and short doubts of punctual type.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	Assessment of the laboratory sessions: The laboratory sessions will be evaluated in a continuous way, on each session. The applied criteria are: - A minimum attendance of 80% - Punctuality - Previous task preparation of the sessions - Make the most of the session The practical sessions will be held in groups of two students. The documents of the practices will be available prior to the sessions. The students will fill report, that will be delivered when the session ends. This report serves to justify both the attendance and how they have done the work asked for.	20		CE11	CT9 CT10 CT17
Objective questions exam	These partial tests evaluate part of the theoretical content of the subject. They will consist of individual objective tests related to a set of topics of the subject.	80	CG3	CE11	CT2 CT9 CT10
Essay questions exam	It will consist of an objective individual test where the entire content of the subject will be evaluated. It will be held at the end of the semester at the times established by the center's management.	80	CG3	CE11	CT2 CT9 CT10

Other comments on the Evaluation

EVALUATION AND GRADING OF THE SUBJECT

The evaluation of the subject is continuousand consists of the following elements:

Self assessment :

Associated with each topic there are severalself-assessment questionnaires. There are short questionnaires after each section or pill into which each topic is divided, and a larger and more comprehensive questionnaire at the end of each topic. These self-assessment questionnaires have no influence on the grade. The purpose of these questionnaires is to help

students assess their level of knowledge about each of the topics. The answers of these questionnaires by the students provide valuable information to the teaching staff about those aspects of the subject in which the students find greater difficulties.

Laboratory sessions:

The evaluation of the laboratory sessions accounts for 20% of the course grade. The laboratory sessions are evaluated one by one, obtaining a grade for each session. The evaluation criteria are: attendance, punctuality, prior preparation and performance. The laboratory session grade (NP) will be obtained by averaging the grades of all the sessions, with the following requisites:

- A minimum attendance of 80% must be recorded, otherwise the laboratory grade will be zero.
- A minimum of 3.3 points in the grade of theory must be reached (NT), otherwise the laboratory grade will be zero.

Theory:

The evaluation of the theory part (NT) accounts for 80% of the course grade. For its evaluation, the subject will be divided into two parts (P1 and P2), each covering approximately 50% of the contents of the subject and three evaluation sessions will be held, distribute das follows:

First session: It will take place approximately in the middle of the semester. This session will exclusively evaluate P1.

Second session: It will be held on the date and time established by the center for the final exam in May. In this session each student will be able to take advantage of one of the following options:

- Incomplete option: Only P2 is examined. Students who have obtained a grade equal to or greater than 3.3 points in P1 may choose this option. If the grade obtained in P2 is equal to or greater than 3.3 points, the resulting grade will be NT = (P1 + P2) / 2. If the grade obtained in P2 is less than 3.3 points, NT will be calculated in the same way, but its maximum value will be limited to 3.6 points.
- Complete option: The student renounces the grade of P1 obtained in the first session and takes a complete exam (EC) of the entire theory. The grade will be NT = EC.

Third session: It will be done on the date and time established by the center for the final exam in July. In this session, the students will take a complete exam (EC). The grade will be NT = EC.

The final grade (NA) will be calculated asfollows: NA = 0.2x (NL) + 0.8x (NT)

Other considerations

For the present academic year, the laboratory qualifications of the two previous years will be kept and considered valid.

Those students to whom the management of thecenter grants the waiver of continuous evaluation will be evaluated, on the same day and time of the final exam established by the center (second and / or third session). The evaluation will consist of two tests: An exam in full modality (EC) with a weight of 80% on the final grade. A specific laboratory test, weighing 20% on the final grade. In principle, this specific test will be carried out after the written test in the electronic laboratories of the corresponding center's site.

In the extraordinary call End of Degre estudents will take a theory exam that will have a weight of 80% on the final grade. The remaining 20% will be obtained from the qualification of aspecific laboratory test.

To pass the course, in any of the previous cases, it is necessary to achieve a final grade equal or higher than 5 points.

Recommendations:

It is very important that the students keep updated the profile in the FAITIC platform. All communications related with this course will be made through this platform. All individual communications will be made through the email listed in this platform.

The students can solve doubts related with the laboratory previous activities in the personal attention hours (tutoring time), or by any other contact procedure available in FAITIC.

The students must meet the deadlines for all the activities.

All the achieved results must be justified, in any of the exams or activities. None of the achieved results will be taken for

good if no explanation is given about the method used to find them. The selected method for solving a problem is considered when grading the solution.

When writing the solutions and answers in reports and tests, avoid spelling mistakes and unreadable symbols.

Exams lacking some of the sheets will not be graded.

Use of cell phones, notes or books is forbidden during exams.

Competencies Acquisition and Its Influence on Assesments

In this subject all the different activitiesare designed to assess the students in the competencies, and the acquisition ofthe competencies defines the final mark. Here follows a description of how thecompetencies and activities are related.
CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
The acquisition of this competency is providedby the contents of the topics of the subject. All activities ofself-assessment, the laboratory sessions and the different test are elaborated to evaluate the knowledge of the technical subjects.
CE11 Knowledge of the fundamentals ofelectronics.
This competency is warrant to be acquired along all the lectures, the laboratory sessions, the self-assessment activities andt he tests.
CT2 Problems resolution.
The students will exercise this competency by means of the following activities: self-assessment activities, bulletin of problems and previous theoretical solution of experiments to be made at the laboratory. This competency is also acquired along all thetest (for each block and the individual one), as they mainly are composed by problems to be solved.
CT9 Apply Knowledge
This competency is mainly acquired during the laboratory sessions, where the theoretical knowledge from problems, designs and simulations should match the assembly of circuits and real measures. Laboratory sessions are evaluated one by one, scoring an average of marks, if there is a minimum number of attended sessions with a minimum score.
CT10 Self learning and work
The self learning process is fundamental to achieve the score to approve the subject. In order to motivate students in the task of acquiring the theoretical knowledgeneed, self-assessment test (on line), lectures based on the remote learningplatform (faitic) and bulletins of problems have been created. Theself-assessment test also provide feedback to the professors about the main difficulties found by students. On thelaboratory sessions, the previous preparation is an explicit method of evaluation. In order to made this preparation, each of the laboratory sessions has its specific documentation and tutorials.
CT17 Working as a team
The students exercise this competency at the laboratory sessions, by making teamsof two people. Cooperation in most of the sessions is needed to perform the assembly of circuits, make the measurements and take notes. The professor in charge of the laboratory session verifies the previous work and how each session is going along, watching that both members cooperate to achieve the best possible result. Scores for students can be different if the professor detects that one of the team member is not cooperating.

Sources of information

Basic Bibliography

Malvino, Albert; Bates, David J., **Principios de Electrónica**, 7ª,

Boylestad, R. L.; Nashelsky, L., **ELECTRÓNICA: TEORIA DE CIRCUITOS Y DISPOSITIVOS ELECTRONICOS**, 10ª,

Rashid, M.H., **CIRCUITOS MICROELECTRONICOS: ANALISIS Y DISEÑO**, 2ª,

TOCCI, RONALD J., NEAL S. WIDMER , GREGORY L. MOSS, **Sistemas digitales. Principios y aplicaciones**, 10ª,

Lago Ferreiro, A.; Nogueiras Meléndez, A. A., **Dispositivos y Circuitos Electrónicos Analógicos: Aplicación práctica en laboratorio**,

Complementary Bibliography

Malik N. R., **Electronic Circuits. Analysis, simulation, and design**,

Wait, J.; Huelsman, L.; Korn, G., **INTRODUCCION AL AMPLIFICADOR OPERACIONAL**, 4ª,

Pleite Guerra, J.; Vergaz Benito, R.; Ruíz de Marcos; J. M., **Electrónica analógica para ingenieros.**,

Recommendations

Subjects that are recommended to be taken simultaneously

Fundamentals of automation/V12G380V01403

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102

Physics: Physics II/V12G380V01202
Mathematics: Algebra and statistics/V12G380V01103
Mathematics: Calculus I/V12G380V01104
Mathematics: Calculus II and differential equations/V12G380V01204
Fundamentals of electrical engineering/V12G380V01303

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 ===

An attempt will be made to ensure that the degree of attendance in teaching activities is the maximum that guarantees the safety and health of all parties involved. In any case, the guidelines will be followed in instructions indicated by the management of the center.
In the event that there is a situation in which the teaching activities cannot be attended, neither the content nor the learning results contemplated in the subject will be affected. To this end, the following adaptations will be made.

Theory sessions:

In the event that they cannot be attended, remote classrooms or any other means enabled by the university will be used for their delivery. The contents taught will be the same.

Laboratory sessions:

In the event that they cannot be attended, remote classrooms or any other means enabled by the university will be used for their delivery. In those situations where the sessions are not face-to-face, simulation tools will be preferably used.

Tutorials:

For the situation of non-attendance, email and, if necessary, telephone or videoconference will be used preferably.

Evaluation:

In the event that the tests cannot be carried out in person, they will be carried out by telematic means. The number of assessment tests will not change, nor will the relative weight of each one of them in the grade of the course.

IDENTIFYING DATA				
Fundamentals of manufacturing systems and technologies				
Subject	Fundamentals of manufacturing systems and technologies			
Code	V12G360V01402			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Diéguez Quintas, José Luís			
Lecturers	Diéguez Quintas, José Luís Fenollera Bolíbar, María Inmaculada			
E-mail	jdieguez@uvigo.es			
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General description	The educational aims of Foundations of Systems and Technologies of Manufacture, in his fundamental and descriptive appearances, centre in the study and the application of scientific knowledges and technicians related with the processes of manufacture of components and conjoint whose functional purpose is mechanical, as well as the evaluation of his dimensional precision and the one of the products to obtain, with a determinate quality. All this including from the phases of preparation until the ones of utilisation of the instruments, the tools, toolings, teams, machines tool and necessary systems for his realisation, in accordance with the norms and specifications established, and applying criteria of optimisation. To reach the aims mentioned will give the following thematic educational: - Foundations of dimensional metrology. Measure of length, angles, forms and elements of machines. - Study, analysis and evaluation of the dimensional tolerances. Chain of tolerances. Optimisation of the tolerances. Systems of adjust and tolerances. - Processes of conformed of materials by means of start of material, operations, scheme, teams and tooling - Processes of conformed by means of plastic deformation, operations, scheme, teams and tooling - Processes of conformed by *moldeo, operations, scheme, teams and tooling - Processes of conformed no conventional, operations, scheme, teams and tooling. - Conformed of polymers, and other no metallic materials, operations, scheme, teams and tooling - Processes of union and assembling, operations, scheme, teams and tooling - Foundations of the programming of scheme with *CNC, used in the mechanical manufacture.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE15	CE15 Basic knowledge of production systems and manufacturing.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency.
CT8	CT8 Decision making.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes			
Learning outcomes		Competences	
(*)		CE15	CT2 CT3 CT9 CT10 CT16 CT20
New	CG3	CE15	CT2 CT10

New		CE15	CT1 CT2 CT3 CT8 CT17
New	CG3	CE15	CT2 CT8 CT9 CT16 CT17 CT20

Contents	
Topic	
DIDACTIC UNIT 1. INTRODUCTION To THE TECHNOLOGIES And SYSTEMS OF MANUFACTURE.	Lesson 1. INTRODUCTION To THE ENGINEERING OF *FABRICACION. The productive cycle. Classification of industries. Technologies of manufacture.
DIDACTIC UNIT 2. *METROTECNIA.	Lesson 2. PRINCIPLES OF DIMENSIONAL METROLOGY. Introduction. Definitions and concepts. The International System of Units. Physical magnitudes that covers the Dimensional Metrology. Elements that take part in the measurement. Classifications of the methods of measure. Patterns. The chain of *trazabilidad. *Calibración. Uncertainty. Chain of *calibración and transmission of the uncertainty. Relation between tolerance and uncertainty. Expression of the uncertainty of measure in *calibración. Lesson 3. INSTRUMENTS And METHODS OF MEASURE. Introduction. Patterns. Instruments of verification. Patterns *interferométricos. Principles of *interferometría. Instruments of direct measure. Methods and instruments of indirect measure. Lesson 4. MEASUREMENT BY COORDINATES. MEASUREMENT BY IMAGE. SUPERFICIAL QUALITY. Machines of measurement by coordinates. Concept. Principles of the MMC. Classification of the machines. Main components of the MMC. Process to be followed for the development of a measure. Systems of measurement by image. Superficial quality. Methods of measure of the *rugosidad. Parameters of *rugosidad.

DIDACTIC UNIT 3. PROCESSES OF CONFORMED BY START OF MATERIAL	Lesson 5. INTRODUCTION To THE CONFORMED BY START OF MATERIAL. Introduction. Movements in the process of start of material. Factors to take into account in the election of the tool. Geometry of tool. Materials of tool. Mechanism of training of the shaving. Types of shavings. Power and strengths of court. Wear of tool. Criteria of wear of tool. Determination of the life of the tool. Flowed of court. Lesson 6. TURNING: OPERATIONS, SCHEME And TOOLING. Introduction. Main operations in lathe. The machine-tool: the lathe. Main parts of the lathe. Setting or subjection of pieces. Typical tools of the lathe. Special lathes. Lesson 7. MILLED: OPERATIONS, MACHINES And TOOLING. Introduction. Description and classification of the operations of milled. Parts and main types of *fresadoras. Types of strawberries. Setting of the tool. Subjection of pieces. Different configurations of *fresadoras. *Fresadoras Special. Lesson 8. MECHANISED OF HOLES And WITH RECTILINEAR MAIN MOVEMENT: OPERATIONS, MACHINES And TOOLING. Introduction to the operations of mechanised of holes. Punches. *Mandrinadoras. General characteristics of the processes of mechanised with rectilinear main movement. *Limadora. *Mortajadora. *Cepilladora. *Brochadora. Saws. Lesson 9. CONFORMED WITH ABRASIVE: OPERATIONS, MACHINES And TOOLING. Introduction to the operations of mechanised of holes. You grind abrasive. Operation of rectified. Types of *rectificadoras. *Honeado. *Lapeado. Polishing. Burnished. *Superacabado Lesson 10. PROCESSES OF MECHANISED NO CONVENTIONAL. Introduction. The mechanised by electroerosion or *electro-download. Mechanised electrochemical. Mechanised by laser. Mechanised by *chorro of water. Court by arch of plasma. Mechanised by ultrasounds. Milled chemist.
DIDACTIC UNIT 4. AUTOMATION And MANAGEMENT OF THE PROCESSES OF MANUFACTURE.	Lesson 11. NUMERICAL CONTROL OF MACHINES TOOL. Introduction. Advantages of the application of the *CN in the machines tool. Necessary information for the creation of a program of *CN. Manual programming of *MHCN. Types of language of *CN. Structure of a program in code ISO. Characters employed. Preparatory functions (G__). Auxiliary functions (M__). Interpretation of the main functions. Examples. Automatic programming in numerical control.

DIDACTIC UNIT 5. PROCESSES OF CONFORMED OF MATERIALS IN LIQUID STATE And GRANULATE.	Lesson 12. GENERAL APPEARANCES OF THE CONFORMED BY FOUNDRY OF METALS. Introduction. Stages in the conformed by foundry. Nomenclature of the main parts of the mould. Materials employed in the conformed by foundry. Flow of the fluid in the system of feeding. Solidification of the metals. Contraction of the metals. The *rechupe. Procedure of calculation of the system distribution of *colada. Considerations on design and defects in pieces melted. Lesson 13. PROCESSES OF MANUFACTURE BY FOUNDRY. Classification of the processes of foundry. *Moldeo In sand. *Moldeo In shell. *Moldeo In plaster. *Moldeo In ceramics. *Moldeo To the CO2. *Moldeo To the stray wax Foundry in full mould. *Moldeo *Mercast. *Moldeo In permanent mould. Foundry injected. Foundry *centrifugada. Ovens employed in foundry. Lesson 14. METALLURGY OF DUSTS (*PULVIMETALURGIA). Introduction. Manufacture of the metallic dusts. Characteristics and properties of the metallic dusts. Dosage and mix of metallic dusts. *Compactación. *Sinterizado. Ovens of sintering. *Sinterizado By download *disruptiva. *Presinterizado. Back operations. Considerations of design. Products *obtenibles by sintering. Lesson 15. CONFORMED OF PLASTICS. Introduction. Polymeric material classification. Physical properties of polymers. Classification of the processes. *Moldeo By extrusion. *Moldeo By injection. *Moldeo By compression. *Moldeo By transfer. *Moldeo Rotational. *Termoconformado.
DIDACTIC UNIT 6. PROCESSES OF CONFORMED BY UNION.	Lesson 16. PROCESSES OF WELDING. Introduction to the processes of welding. Welding with electrical arch. Welding by resistance. Welding with oxygen and gas fuel .Welding with temperature of fusion of metal of lower contribution that the one of the metals to join. Lesson 17. PROCESSES OF UNION And SETTING WITHOUT WELDING. Processes of union by means of adhesive. Resistance to the adhesion. Conditions for the hit. Design of unions Types of adhesive according to origin and composition. Processes of mechanical union. Removable mechanical unions and permanent.
DIDACTIC UNIT 7. PROCESSES OF CONFORMED BY PLASTIC DEFORMATION OF METALS.	Lesson 18. GENERAL APPEARANCES OF THE CONFORMED BY PLASTIC DEFORMATION. Introduction. Curves of effort-deformation. Expressions of the deformation. Proof of the volume. Approximate models of the curve encourage real-natural deformation. State of flat deformation. Primary and secondary processes. Processes of work in hot and in cold. Conditions and control of the process. Lesson 19. PROCESSES OF *LAMINACIÓN And FORGES. *Laminación: Foundations; temperature of *laminación; teams for the *laminación in hot; characteristics, quality and tolerances of the products *laminados in hot; *laminación in cold. It forges: free; in matrix of impression; in press; by *recalcado; header in cold; by *laminación; in cold. Lesson 20. EXTRUSION, *EMBUTICIÓN And AFFINE. Extrusion. Pulled of bars and tubes. *Trefilado. Reduction of section. *Embutición. *Repujado In lathe. Attainable pieces by *repujado: considerations of design. Forming by pulled. Forming with pads of rubber and with liquid to pressure. Forming to big power. Lesson 21. CONFORMED OF METALLIC SHEET. *Curvado Or bent of sheets. *Curvado With rollers. Conformed with rollers. *Enderezado. *Engatillado. Operations of cut of sheet.

PROGRAM OF PRACTICES	Practice 1.- Utilisation of the conventional devices of metrology. Measurement of pieces using foot of normal king and of depths and micrometer of outsides and inner. Employment of clock comparator. *Comprobación Of flat surfaces. Use of calibrate raisin/does not happen, rules, squares and *calas pattern. Measurement and *comprobación of threads. Realisation of metric measurements and in English units. Practice 2.-Indirect measurements. *Comprobación Of a cone using rollers and a foot of king, measurement of a tail of *milano using rollers, measurement of the angles of a double tail of *milano and measurements using a rule of breasts. Direct measurements with goniometer. Practice 3.- Machine of measurement by coordinates. Establish a system of coordinates. Check measures in piece, using a machine to measure by coordinates. Verify tolerances forms and position. Practice 4.- Manufacture with machines conventional tools. Manufacture of a piece employing the lathe, the *fresadora and the *taladro conventional, defining the basic operations and realising them on the machine. Practice 5.- Selection of conditions of computer-aided court. Realisation of leaves of process of three pieces using program of planning of Practical computer-aided processes 6, 7 and 8.- Initiation to the numerical control applied to the lathe and to the *fresadora. Realisation of a program in *CNC using a simulator, with the main orders and simpler; realising at the end diverse pieces so much in the lathe as in the *fresadora of the classroom workshop. Practice 9.- Welding. Knowledge of different teams of electrical welding. *Soldeo Of different materials employed the technicians of electrode *revestido, *TIG and *MIG.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	0	32.5
Laboratory practical	18	0	18
Objective questions exam	0	2	2
Laboratory practice	0	50	50

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

Methodologies

	Description
Lecturing	The theoretical classes will realise combining the explanations of blackboard with the employment of videos and presentations of computer. The purpose of these is to complement the content of aim them, interpreting the concepts in these exposed by means of the sample of examples and the realisation of exercises.
Laboratory practical	The practical classes of laboratory will realise in 9 sessions of 2 hours, except the students of the course bridge that will realise the practices in the 6 sessions that contemplates his particular schedule, in groups of 20 maximum students, and employing the available resources of instruments and machines, combining with the simulations by computer.

Personalized assistance

Methodologies	**Description**
Lecturing	
Laboratory practical	
Tests	**Description**
Objective questions exam	
Laboratory practice	

Assessment

Description	Qualification	Evaluated Competencess

Objective questions exam	It TESTS TYPE To (for all the students -60% final note-) The character of this proof is written and face-to-face, is compulsory for all the students, with or without continuous evaluation. It will be composed this proof by 20 ask type test on the theoretical and practical contents. The assessment of tests it type test will realise in a scale of 6 points, what represents 60% of the total note, being necessary to obtain at least 2 points, so that together with the practical proofs can obtain at least 5 points and surpass the matter The note of this test will obtain adding 0,3 points by each properly answered question and will subtract 0,1 points if the question is resolved of wrong form. The questions in white do not mark.	60	CG3 CE15	CT1 CT3 CT8 CT9 CT10 CT16
Laboratory practice	It TESTS TYPE *B (continuous evaluation -30% final note-): Two test type test to realise in the schedule of class, consistent in 5 questions on the matter given until the moment, each correct question will cost 0,3 points and the wrong will subtract 0,1 points. The questions in white do not mark. Each proof will be therefore 15% of the final note. It TESTS TYPE C (continuous evaluation -10% final note-): A proof written or work to propose by the professor along the *cuatrimestre. This proof will value with a maximum of 1 point, 10% of the final note. These notes will add to the qualification of tests it type test, to be able to obtain at least 5 points and surpass the matter. It TESTS TYPE (renunciation to the continuous evaluation -40% final note-): Resolution of several practical problems, whose value will be 40% of the final note, or was at most 4 points, being necessary to obtain a minimum of 1 point in this second proof so that the qualification can add to the one of tests it type test, and if it equalises or surpasses 5 points, approve the matter. This tests type D, will realise it the students to which have conceded them the renunciation to the continuous evaluation, and will realise the same day that realise tests it compulsory test, after this have finalised.	40	CE15	CT2 CT8 CT9 CT10 CT16 CT17 CT20

Other comments on the Evaluation

<*p>APPROVED</*p><*p>Students described by means of continuous evaluation:</*p><*p>To surpass this matter is necessary at least obtain 5 points adding the punctuation of test them types □To□, □*B□ and □C□. </*p><*p>All the students in principle will have to follow the procedure of continuous evaluation, except those that on purpose renounce in the term and form that mark the school. </*p><*p>&*nbsp;Students described with renunciation conceded to the continuous evaluation:</*p><*p>To surpass this matter is necessary at least obtain 5 points adding the punctuation of test them types □To□ and □D□.</*p><*p>ASSISTANCE To PRACTICAL CLASSES</*p><*p>The assistance to practical classes is not compulsory, but will be always matter of examination the in them given.</*p><*p>ANNOUNCEMENT OF 2º EDITION</*p><*p>Students with continuous evaluation, qualification in the announcement of 2º edition: </*p><*p>&*nbsp;This second edition of the ordinary announcement will describe as the following way: </*p><*p>- By means of the realisation of the compulsory proof type □To□ </*p><*p>- conserve the qualifications of the two test type □*B□ in this 2ª opportunity, but will be able to , if it wishes , improve this qualification, by means of the repetition of these test type □*B□ when finalising tests it type □To□.</*p><*p>- Will keep the punctuation reached in tests it type □C□ by maximum value of 1 point, but will be able to improve this note if it wishes by means of a proof written or work to propose by the professor, to deliver before the day of the announcement of this second edition.</*p><*p>To surpass this matter is necessary at least obtain 5 points adding the three previous proofs. </*p><*p>The notes of the proofs of continuous evaluation, corresponding to 40% of the final qualification, will not conserve of a course for another. </*p><*p>Students without continuous evaluation, qualification in the announcement of 2º edition: </*p><*p>The students that do not realise continuous evaluation, due to the fact that the centre has accepted them the renunciation, always will have to realise in all the announcements tests it type □To□ (by value of 6 points) and tests it type □D□ (by value of 4 points), in the terms specified in the previous sections. </*p><*p>To surpass this matter is necessary at least obtain 5 points adding the two previous proofs. </*p><*p>EXTRAORDINARY ANNOUNCEMENT: </*p><*p>This proof will be equal for all the students and will consist in one tests it type □To□ (by value of 6 points) and tests it type □D□ (by value of 4 points), in the terms specified in the previous sections. </*p><*p>To surpass this matter is necessary at least obtain 5 points adding the two previous proofs. </*p><*p>ETHICAL COMMITMENT:</*p><*p>expects that the present student a suitable ethical behaviour, free of fraud. In case to detect a no ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices, for example) will consider that the student does not gather the necessary requirements to surpass the matter. In this case the global qualification in the present academic course will be of suspense (0.0).</*p>

Sources of information

Basic Bibliography

Complementary Bibliography

Dieguez, J.L.; Pereira, A.; Ares, J.E:, ´**Fundamentos de fabricación mecánica**,

Alting, L., **Procesos para ingenieria de manufactura**,
De Garmo; Black; Kohser, **Materiales y procesos de fabricación**,
Kalpakjian, Serope, **Manufactura, ingeniería y tecnología**,
Lasheras, J.M., **Tecnología mecánica y metrotecnia**,

Recommendations

Subjects that continue the syllabus

Manufacturing engineering and dimensional quality/V12G380V01604

Subjects that are recommended to be taken simultaneously

Materials science and technology/V12G350V01305

Other comments

Requirements: To enrol of this matter is necessary to have surpassed or be enrolled of all the matters of the inferior courses to the course to the that is *emplazada this matter.

In case of discrepancies, will prevail the version in Spanish of this guide.

Contingency plan

Description

The contents and the results of learning will not owe to be modified for power guarantee the collected in the memories of the qualifications. It owes to treated to adjust the materials, tutorships and the teaching methodologies to treat to achieve these results. It treats of an aspect of big importance stop the overrun of the processes of the one who are subjected the different qualifications. And say, the plan of contingency owes to based in a development of the subject, adapting the methodologies and the materials, in the research of the fulfilment of the resulted of learning of all the students.

The teaching methodologies will impart , to be necessary, to the telematic means that put the disposal of the teaching staff, in addition to the documentation facilitated through FAITIC and other platforms, email, etc.

When it was not possible to presential sesions, in the measure of the possible, will prevail the contained theorists by telematic means as well as those contents of practices of resolution of problems, classroom of computing, and others, that can be virtuals or developed pole students of way guided, tried keep the presential stop the experimental practices of laboratory, always that the groups fulfil with the rule established in the moment by the authorities in sanitary subject and of security. In the case of no power be imparted of form presential, those contents no virtuals will impart or by others (autonomous work guided, etc.) Enabling achieve equally the competitions associated it they. The titorships will be able to developed indistinctly of form presential (always that it was possible to guarantee the sanitary measures) or telematic (and email and others) respecting or adapting the schedules of titorships due. it will do a adecuation methodological to the students of risk, facilitating him additional specific information, to accredit that can not have access to the contained imparted of conventional form.

Additional information envelope to evaluation: they will keep those proofs that already come realizing of telematic form and, in the measure of the possible, will keep the proofs presentials to the normative valid medic. The proofs will develop of form presential except Resolution Reitoral that indicate that they owe do of form non-presential, realizing gave way through the distinct tools put the disposal of the teaching staff. Those proofs no-don of telematic form by others (deliveries of autonomous work guided, etc.)

IDENTIFYING DATA				
Fluid mechanics				
Subject	Fluid mechanics			
Code	V12G360V01403			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator				
Lecturers	2021_22_agardap6anualvi_600 , Gil Pereira, Christian			
E-mail				
Web				
General description	(*)Nesta guía docente preséntase información relativa á materia Mecánica de Fluídos de 2º curso do grao en Tecnoloxías Industriais, no que se continúa de forma coordinada un achegamento ás directrices marcadas polo Espazo Europeo de Educación Superior. Neste documento recóllense as competencias xenéricas que se pretende que os alumnos adquiran neste curso, o calendario de actividades docentes previsto e a guía docente de materia. A Mecánica de Fluídos describe os fenómenos físicos relevantes do movemento dos fluídos, describindo as ecuacións xerais dos devanditos movementos. Este coñecemento proporciona os principios básicos necesarios para analizar calquera sistema no que o fluído sexa o medio de traballo. Estes principios requírense en: - Deseño de maquinaria hidráulica - Lubricación - Sistemas de calefacción e ventilación, calor e frío. - Deseño de sistemas de tubaxes - Medios de transporte: transmisión, climatización, sistema de escape, aerodinámica e hidrodinámica, refrixeración,etc - Aerodinámica de estruturas e edificios			

Competencies	
Code	
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
CE8	CE8 Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering. Calculation of pipes, channels and fluid systems.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
Understand the basic principles of the fluid movement.	CG4	CE8	CT9 CT10
Capacity to calculate pipes and channels.	CG5	CE8	CT2 CT9 CT10
Capacity to know and dominate the tools to solve the problems of fluids and flows.	CG4 CG5	CE8	CT2 CT9 CT10
Capacity to handle meassurementes of flow magnitudes	CG5	CE8	CT9 CT10

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8. EXPERIMENTATION WITH FLOWS. DISCHARGE MEASUREMENT. PRESSURE MEASUREMENT. SPEED MEASUREMENT.	8. 1 PRESSURE GAUGES 8.1.1 Simple pressure gauge 8.1.2 Bourdon pressure gauge 8.1.3 Transductor of pressure 8.2 SPEED MEASUREMENT 8.2.1 Pitot tube 8.2.2 Prandt tube 8.2.3 Rotative anemometer 8.2.4 Hot thread anemometer 8.2.5 Llaser-dopler anemometer 8.3 FLOW MEASSUREMENT 8.3.1 Differential pressure: diaphragm, venturi, nozzle. 8.3.2 Other types.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	70.5	103
Problem solving	5.6	15	20.6
Mentored work	5.8	0	5.8
Laboratory practical	12	0	12
Essay questions exam	1.5	0	1.5
Laboratory practice	5.6	0	5.6
Problem and/or exercise solving	1.5	0	1.5

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

Methodologies

	Description
Lecturing	Explain the fundamentos of each subject with practical problems. That includes activities as: master lesson Readings bibliographic Review Summary Diagrams Solution of problems Conferences Presentations
Problem solving	Solve exercises and problems, employing the theoretical basics directly. Solve also problems of industrial application, more focused in real applications, close to practice of engineering.
Mentored work	Works of practical applications, projects, design, creative and novelty subjects of practical applications of fluid mechanics
Laboratory practical	Will apply the concepts developed of each subject to the realization of practices of laboratory. Fundamentally, we will do experimental activities: practical lessons Simulation Solution of problems Collaborative learning

Personalized assistance

Methodologies	Description
Laboratory practical	Before the start of the course the official office hours will be published in the virtual platform, Faitic.
Lecturing	Before the start of the course the official office hours will be published in the virtual platform, Faitic. Provisional schedules (Eduardo Suárez Port. Desp.327): Wednesdays: 17:30-20:30

Assessment

	Description	Qualification	Evaluated Competencess		
Problem solving	Resolutions of practical problems related with the contained imparted in one fear particular of theory.	8	CG4		CT2 CT9
Mentored work	Works of application and demonstration of the principles fundamentáis of the mecánico of fluidos.	2	CG4		CT9
Essay questions exam	Write proof that will be able to feature of: theoretical questions practical questions resolution of exercises/problems subject to develop	80	CG4 CG5	CE8	CT2 CT9 CT10
Laboratory practice	Practical realization in Laboratory. Report of the activities realized in the sessions of laboratory, results of the experimentation, etc.	5	CG4 CG5	CE8	CT2 CT9 CT10
Problem and/or exercise solving	Short escrito proofs, that can be of practical questions of laboratory or of conteptos of theory.	5	CG4	CE8	CT9

Other comments on the Evaluation

The continuous evaluation considered until July, pole that the calificacións managed in all the activities realized previously will keep tie the announcement of July.

The exact percentages can divert slightly of the indicated because of the management, or factibilidade of realization of the

different practical proofs, and when attributing him to the complementary activity (Work and projects) an upper assessment, being able to even surpass the 10 how maximum qualification alcadable.

Anyway the weight of a 80% of the proof of long answer will keep invariable.It expects that the present student an ethical behaviour appropriate. In case to detect a no ethical behaviour (copy, plaxio, utilization of electronic devices no authorized, for example), will consider that the student does not gather the necessary requirements to surpass the subject. Depending of the type of behaviour no ethical detected, be able to conclude that the student did not achieve the necessary competitions.
It will not allow the utilization of any electronic device during them test of evaluation except autorización expresses. The fact to enter an electronic device no authorized in the classroom of exame will be considered reason of no superación of the subject in the present academic course and the global qualification will be of suspenso (0.0).

Sources of information

Basic Bibliography

Frank M White, **Mecánica de Fluidos**, 6ª, McGraw-Hill Interamericana de España S.L, 2008

Robert L. Mott, **Mecánica de fluidos**, 7ª, Pearson, 2015

Antonio Crespo, **Mecánica de fluidos**, 1ª, Thomson, 2006

Complementary Bibliography

Robert W. Fox, Alan T. McDonald, **Introducción a la mecánica de fluidos**, 2ª, McGraw-Hill, 1995

Merle C. Potter, David C. Wiggert, **Mecánica de fluidos**, 3ª, Thomson, 2002

Victor L. Streeter, E. Benjamin Wylie, Keith W. Bedford, **Mecánica de fluidos**, 9ª, McGraw-Hill, 2000

Yunus A. Çengel, John M.Mecánica de fluidos : fundamentos y aplicaciones Cimbala, **Mecánica de fluidos: fundamentos y aplicaciones**, 2ª, McGraw-Hill Interamericana de España S.L, 2006

Elena Martín Ortega, Concepción Paz Penín, **Prácticas de laboratorio de mecánica de fluidos**, 1ª, Gallega de Mecanización, 2006

Philip M. Gerhart, Richard J Gross, , Jonh I. Hochstein, **FUNDAMENTOS DE MECANICA DE FLUIDOS**, 2ª, Adison-Wesley Iberoamericana, 1995

Recommendations

Subjects that continue the syllabus

Hydraulic turbomachines/V12G360V01504
Final Year Dissertation/V12G360V01991

Subjects that are recommended to be taken simultaneously

Thermodynamics and heat transfer/V12G380V01302

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Mathematics: Algebra and statistics/V12G380V01103
Mathematics: Calculus I/V12G380V01104
Mathematics: Calculus II and differential equations/V12G380V01204

Other comments

Recommends to the student:
Assistance to class
Dedication of the autonomous personal work hours to the subject

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				
Mechanics of materials				
Subject	Mechanics of materials			
Code	V12G360V01404			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Cabaleiro Núñez, Manuel Riveiro Rodríguez, Belén			
Lecturers	Cabaleiro Núñez, Manuel Caride Tesouro, Luís Miguel Conde Carnero, Borja Pece Montenegro, Santiago Pereira Conde, Manuel Riveiro Rodríguez, Belén			
E-mail	mcabaleiro@uvigo.es belenriveiro@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Introduction to linear elastic materials, and analysis of internal loadings, stress and strain relationships. Study of the fundamentals of mechanics of materials and particularization for shafts and beam structures.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE14	CE14 Knowledge and use of the principles of strength of materials.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
To know the differences between rigid solid and elastic solid.	CG3	CE14	CT1
To know the stress and deformation states in a deformable solid and the relationship between them.	CG4		CT2 CT9
Apply the acquired knowledge to the determination of the maximum values of stress at a point of a deformable solid.			CT10 CT16
To know the basic principles governing the Mechanics of Materials.			CT17
To know the relationships between the different stress resultants and the stresses.			
To apply the knowledge acquired to the determination of stress resultant diagrams.			
To apply the acquired knowledge about stresses applied to bar elements.			
To know the basics about deformations of bar elements.			
To apply the knowledge acquired to the dimensioning of bar elements.			

Contents	
Topic	
1. Introduction	1.1 Introduction 1.2 Review of statics fundamentals and applied concepts for further progress in solid mechanics and stress analysis

2. Basic principles of elasticity and mechanics of materials.	2.0 Stress and strain. Linear elastic materials 2.1. Normal stress in an axially loaded prismatic bar. 2.2. Equilibrium of a deformable body. 2.3. Stress-Strain diagram of ductile materials. Hooke's Law. 2.4. Stress resultants. Diagrams.
3. Axial loads	3.1. Normal forces. 3.2. Elastic deformation of an axially loaded member. 3.3. Statically governed problems. 3.4. Statically indeterminate problems. 3.5. Thermal stress and assembly misfits.
4. Bending and shear	4.1 Beams: definition and types. Loads on beams. 4.2 Internal shear forces and bending moments. 4.3 External load, shear force and bending moment relationships. 4.4 Shear and moment diagrams 4.5 Pure bending and non-uniform bending. Hypothesis and limitations. 4.6. Normal stresses in unsymmetric bending. 4.7 Symmetric bending. The flexure formula (Navier's Law). 4.8 Section modulus of a beam. Ideal beam cross-section. 4.9 Deflection of beams and shafts. Slope and deflection. 4.10 Hyperstatic bending. 4.11 The shear formula.
5. Introduction to compressive buckling	4.1. Definition 4.2. Critical load. Euler's formula. 4.3. Limitations of Euler's formula. 4.4. Practical applications.
6. Introduction to torsion	6.1. Definition. 6.2. Torsion in circula shafts. 6.3. Torque diagrams.. 6.4. Torsional stresses and deformations.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	49	81.5
Laboratory practical	9	23	32
Project based learning	9	24.5	33.5
Essay questions exam	3	0	3

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

Methodologies

	Description
Lecturing	Lecture where theoretical principles are presented using digital media, videos and blackboard.
Laboratory practical	Activities of application of the knowledge to concrete situations and of acquisition of basic skills and procedural skills related with the subject of study.
Project based learning	Resolution of problems related to real case studies

Personalized assistance

Methodologies	Description
Laboratory practical	The students can ask the lecturers for the clarification of those concepts presented in the lecturers and practicals, as well as to clarify / discuss any doubts that may appear after the end of the sessions. The tutoring sessions may be carried out by telematic means (Remote Campus, Faitic, etc.) under the modality of prior agreement.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	A) it will evaluate the attendance and active participation in all the practicals of the semester, as well as the correct delivery (time and form) of all the documentation requested (reports, exercises, etc.). Practical sessions will be held in a fixed date, so it is not possible to attend the practical in a later date. Whether the student does not attend to a practical, he/she must demonstrate that the absence was due to unavoidable reasons (e.g. medical reasons). Practicals will marked with the value indicated, only when the student reaches the minimum mark in the written exam, which is 45%. (See following section: 'Other comments')	2.5	CG3 CG4	CE14	CT1 CT2 CT9 CT10 CT16 CT17

Project based learning	C) Written tests to evaluate the individual work delivered by the student. It will be compulsory the attendance to the 90% of the practicals to obtain the marks given in section C. The marks obtained in the sections A will proportionally affect to the marks of the section C. The section C will be marked with a maximum value of 12,5% of the total mark, only when the student reach the minimum mark in the written exam, which is 45%. (See following section: 'Other comments')	12.5	CG3 CG4	CE14	CT1 CT2 CT9 CT10 CT16
Essay questions exam	Written exam in the dates established by the School.	85	CG3 CG4	CE14	CT1 CT2 CT9 CT10 CT16

Other comments on the Evaluation

Students resigning continuum assessment (after School aproval) will be evaluated only through the written exam which will be graded with 100% of final mark.

Continuum assessment is composed of sections A and C. The maximum mark for continuum assessment (NEC) is 15%, which will be computed from the following equation: NEC (%) = 0,25·(A) + 1,25·(C)·(A) ; where A and C are granted 0-1.

Ethical commitment: it is expected an adequate ethical behavior of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Sources of information

Basic Bibliography

Hibbeler, R., **Mechanics of materials**,

Manuel Vázquez, **Resistencia de materiales**,

Complementary Bibliography

Ortiz Berrocal, L., **Resistencia de materiales**, Ed. McGraw-Hill,

González Taboada, J.A., **Tensiones y deformaciones en materiales elásticos**, Ed. Autor,

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

Recommendations

Other comments

Requirements: To register for this module the student must have passed or be registered for all the modules of the previous year.

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 that do not change
All the methodologies keep being the same as they can be held using the Campus Remoto platform complemented with faitic:
- Lecturing
- Project based learning

- Laboratory practical (only if mix teaching is adopted)

* Teaching methodologies to be modified
- "Laboratory practical" will be substituted by "Systematic observation", which will be measured by carrying out experiments or reports that the students can carry out from their homes. The periodicity would be weekly and of temporary dedication equivalent to the laboratory practices.

* Non-attendance mechanisms for students personal attention (tutoring)
The tutoring will be carried out by email to the teacher of the subject, who will be able to solve the doubts by email, or invite the student to participate in a tutorial through the remote teaching tools, Remote Campus, Teams, etc.).

* Changes in the contents (if applicable)
No modification in the contents is envisaged.

* Additional bibliography
Detailed notes will be provided to complement the material presented in the classes taught through the Remote Campus.

* Other

=== ADAPTATION OF THE ASSESSMENT ===
* Tests that are modified
[Laboratory practical] => [Systematic observation] [5%]
(this correspond to mark "A", in the formula for continuos assessment)

[Project based learning]=> [Resolution of exercises] [10%]
(this correspond to mark "C", in the formula for continuos assessment)

The Continuous Assessment Mark (NAC), will be calculated as follows: NAC = (0'5·A) + 1,0 (C)·A; where A y C: 0-1.

[Essay question exam] => [Essay question exam] [50%]

* New Tests
[objective questions exam][35%]
Throughout the course, questionnaires will be carried out for the subjects previously taught, so that the subject can be monitored using telematic means.

* Additional information

IDENTIFYING DATA				
Termodinámica e trasmisión de calor				
Subject	Termodinámica e trasmisión de calor			
Code	V12G360V01405			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Santos Navarro, José Manuel Baqueiro Vidal, María			
Lecturers	Baqueiro Vidal, María Morán González, Jorge Carlos Pazo Prieto, José Antonio			
E-mail	josanna@uvigo.es maria.baqueiro.vidal@uvigo.es			
Web				
General description	Na práctica totalidade dos procesos industriais requírese a aplicación dos Principios da Termodinámica e da Transferencia de Calor. O coñecemento destes principios é básico en Enxeñaría Térmica. Por exemplo, para a realización dunha análise enerxética (con determinación do rendemento enerxético e *exergético) de sistemas de potencia para a xeración de electricidade (ciclo combinado con *turbina de vapor e de gas), un ciclo de potencia mecánica, un ciclo en bomba de calor, etc. O coñecemento de se un proceso termodinámico pode ocorrer ou non na realidade é imprescindible para o deseño de novos procesos, así como o coñecemento das máximas prestacións que se poden obter nos diferentes dispositivos que compoñen unha instalación enerxética, e cales son as causas que imposibilitan obter esas máximas prestacións. Ademais, o estudo das propiedades termodinámicas dos fluídos de traballo que circulan polos dispositivos, auga, aire, *refrigerantes, gases e mestura de gases, é indispensable para analizar o comportamento dos sistemas térmicos. Así mesmo, o estudo do procedemento a seguir para a análise enerxética de instalacións enerxéticas de sistemas de refrixeración, acondicionamento de aire e en procesos de combustión é de gran interese. Doutra banda, é interesante para o alumno coñecer os mecanismos polos cales se produce a transferencia da enerxía, principalmente debido a unha diferenza de temperaturas, centrándose en determinar a maneira e a velocidade á que se produce ese intercambio de enerxía. Neste sentido preséntanse o tres modos de transferencia de calor e os modelos matemáticos que permiten calcular as velocidades de transferencia de calor. Así se pretende que os alumnos sexan capaces de expor e resolver problemas *ingenieriles de transferencia de calor mediante o uso de ecuacións *algebraicas. Tamén se pretende que os alumnos coñezan outros métodos matematicamente máis complexos de resolución de problemas de transferencia de calor e saiban onde atopalos e como usalos en caso de necesitalos.			

Competencias	
Code	
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CG5	CG5 Coñecementos para a realización de medicións, cálculos, valoracións, taxacións, peritaxes, estudos, informes, planes de labores e outros traballos análogos.
CG6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
CG7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
CG11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
CE7	CE7 Coñecementos de termodinámica aplicada e transmisión de calor. Principios básicos e a súa aplicación á resolución de problemas de enxeñaría.
CT2	CT2 Resolución de problemas.
CT7	CT7 Capacidade de organizar e planificar.
CT9	CT9 Aplicar coñecementos.
CT10	CT10 Aprendizaxe e traballo autónomos.
CT17	CT17 Traballo en equipo.

Resultados de aprendizaxe	
Learning outcomes	Competences

Capacidade para coñecer, entender e utilizar os *prinicpios e fundamentos da termodinámica aplicada	CG5 CG6 CG7	CE7	CT2 CT7 CT9 CT10 CT17
Capacidade para coñecer e *entendr o principio e fundamentos da *transmision da calor	CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT17
Capacidade para coñecer e entender os principios e fundamentos de equipos e xeradores térmicos	CG4 CG5 CG6 CG7	CE7	CT2 CT7 CT9 CT10 CT17
Analizar o funcionamento de sistemas térmicos, como sistemas de bomba de calor e ciclos de refrixeración ou ciclos de potencia, identificando compoñentes, así como os ciclos empregados para obter altas prestacións	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT17

Contidos
Topic
REVISIÓN DO PRIMEIRO E SEGUNDO PRINCIPIO DA TERMODINÁMICA
PROPIEDADES DE SUSTANCIAS PURAS: MANEXO DE TÁBOAS E *DIAGRAMAS
ANÁLISE DE SISTEMAS ABERTOS SEGUNDO A PRIMEIRA E SEGUNDA LEI DA TERMODINÁMICA
APLICACIÓNS DA ENXEÑARÍA TERMODINÁMICA: CICLOS DE POTENCIA E CICLOS DE REFRIXERACIÓN
CONCEPTOS E PRINCIPIOS FUNDAMENTAIS DA TRANSMISIÓN DE CALOR
TRANSMISIÓN DE CALOR POR CONDUCIÓN. CONDUCIÓN EN RÉXIME PERMANENTE *UNIDIRECCIONAL
TRANSMISIÓN DE CALOR POR *CONVECCIÓN: FUNDAMENTOS E CORRELACIÓNS DE *CONVECCIÓN
TRANSMISIÓN DE CALOR POR RADIACIÓN: PRINCIPIOS XERAIS. RADIACIÓN TÉRMICA
APLICACIÓNS INDUSTRIAIS: INTERCAMBIADORES DE CALOR

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	65	97.5
Prácticas de laboratorio	6	0	6
Resolución de problemas de forma autónoma	0	18.5	18.5
Resolución de problemas	12	12	24
Resolución de problemas e/ou exercicios	0	3	3
Exame de preguntas obxectivas	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Exposición por parte do profesor dos contidos da materia obxecto de estudo, onde se procurará a máxima participación do alumno, a través da súa implicación directa na formulación de cuestións e/ou problemas,
Prácticas de laboratorio	Experimentación de procesos reais en laboratorio e que complementan os contidos que se imparten na materia
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno levará a cabo mediante a consulta da bibliografía

Resolución de problemas	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno realizará en aula e/ou laboratorio. Resolveranse problemas de carácter "tipo" e/ou exemplos prácticos. Salientarase o traballo en expor métodos de resolución e non nos resultados.

Atención personalizada

Methodologies	Description
Lección maxistral	Formulación de dúbidas en horario de *tutorias. O alumno exporá, durante o horario dedicado ás *tutorías, as dúbidas concernentes aos contidos que se desenvolven na materia, e/ou exercicios ou problemas que se expoñan relativos á aplicación dos contidos
Prácticas de laboratorio	Formulación de dúbidas en horario de prácticas. O alumno exporá, durante o horario dedicado ás prácticas, as dúbidas relativas aos conceptos e desenvolvemento das citadas prácticas
Resolución de problemas	Formulación de dúbidas en horario de *tutorias. O alumno exporá, durante o horario dedicado ás *tutorías, as dúbidas concernentes aos contidos que se desenvolven na materia, e/ou exercicios ou problemas que se expoñan relativos á aplicación dos contidos

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas e/ou exercicios	Exame final escrito consistente na resolución de problemas de resposta extensa, ou exercicios e/ou cuestións teóricas, relativos aos contidos da materia desenvolvida e en tempo/condicións establecido/as polo profesor Os alumnos deben desenvolver, relacionar, organizar, xustificar e presentar os coñecementos que teñen sobre os contidos da materia en respostas argumentadas. Este exame levará a cabo nas datas fixadas pola organización docente do centro Resultados de aprendizaxe: Capacidade para coñecer, entender e utilizar os principios e fundamentos da *termodinámica aplicada e a transmisión de calor, argumentando as solucións propostas	80	CG4 CG5 CG6 CG7	CE7	CT2 CT7 CT9 CT10
Exame de preguntas obxectivas	Ao longo do cuadrimestre realizaranse varias probas de seguimento. A nota correspondente ás diferentes probas de seguimento estará baseada en probas escritas de resposta curta, incluída a próba tipo Test. Esta nota corresponderase coa denominación de Avaliación Continua	20	CG6	CE7	CT2 CT7 CT9 CT10

Other comments on the Evaluation

La materia pode ser superada a través de dúas modalidades:

A) **Modalidade de seguimento por Avaliación Continua**.

A cualificación final (CF) do alumno determinarase sumando os puntos obtidos no exame final (EF) e os obtidos por avaliación continua (AC)

Cada matricula na materia, no curso, supón a posta a cero das cualificacións nas actividades de avaliación continua obtida en cursos anteriores

Segundo a Normativa de Avaliación Continua, os alumnos suxeitos a Avaliación Continua que se presenten a algunha actividade avaliable recollida na Guía Docente da materia, serán considerados como "presentados" e teráselles en conta para a cualificación final

Para a realización das probas consideradas como Avaliación Continua non se permitirá ningunha clase de formulario ou similar, nin calculadora. Estas probas de seguimento poderán ser realizadas nas horas presenciais de docencia (durante as sesións en aula e/ou sesións de problemas e/ou laboratorio) ao longo do curso, e en consecuencia, en calquera momento e sen previo aviso.

A cualificación das probas consideradas como Avaliación Continua terán unha validez nas dúas edicións do curso actual.

B) **Modalidade de renuncia á Avaliación Continua**.

Aqueles alumnos que obteñan oficialmente a renuncia á avaliación continua, utilizando as canles previstas pola escola, serán avaliados, nas datas oficiais fixadas polo centro, mesmo día e hora, das dúas convocatorias/edicións, mediante unha avaliación específica.

Esta avaliación específica terá en conta todos os contidos impartidos na materia (teoría, problemas e prácticas de laboratorio), e suporá o 100% da nota máxima. Constará de dous partes:

1.- Proba escrita (EF), cun peso do 80% sobre a cualificación final, idéntica ao exame final dos demais alumnos que seguen a modalidade de avaliación continua

2.- Unha proba específica (AC), cun peso dun 20% sobre a cualificación final. Esta proba específica incluirá tanto os contidos impartidos nas sesións de teoría como das sesións prácticas de laboratorio. Non se permitirá ningunha clase de formulario ou similar, nin calculadora nestas probas. Calquera evidencia deste tipo de proba considerarase avaliable e non se permitirá a súa repetición.

Os criterios de cualificación que, a continuación, detállanse aplícanse a ambas as modalidades de superación da materia

Criterios de cualificación.

Non se esixirá unha nota mínima no exame final para sumar a correspondente nota de avaliación continua. En calquera caso é necesario obter unha cualificación final igual ou superior a 5 puntos para aprobar a materia

Nas solucións propostas no exame final o alumnado deberá xustificar ou argumentar todos os resultados que se propoñan. Teranse en conta o desenvolvemento explicativo empregado para chegar á solución proposta e non se dará ningún resultado por "sobreentendido".

En *primeira edición* da convocatoria ordinaria a cualificación do alumnado (CF) calcularase tendo en conta o criterio:

$$CF = 0.2*AC + 0.8*EF$$

En *segunda edición* da convocatoria ordinaria a cualificación do alumnado (CF) calcularase seguindo o criterio:

$$CF = \text{máximo}(N1, N2),$$

sendo,

$$N1 = 0.2*AC+0.8*EF$$

$$N2 = EF$$

Para a segunda edición mantéñense a puntuación alcanzada na Avaliación Continua da primeira edición (AC), de ambas as modalidades.

Empregarase un sistema de cualificación numérica de 0 a 10 puntos segundo a lexislación vixente (RD 1125/2003 de 5 de setembro, BOE de 18 de setembro)

CONVOCATORIA EXTRAORDINARIA DE FIN DE CARREIRA: poderán ter un formato de exame distinto ao detallado anteriormente. Realizarase mediante un exame escrito no que se abordarán os aspectos máis relevantes da materia, tanto en cuestións teóricas como a través de problemas de resolución numérica que permitirá obter o 100% da avaliación e deberase alcanzar un mínimo do 50% para superar a materia.

Todas as probas, ben as correspondentes á Avaliación Continua como ao Exame Final, deberán realizarse a bolígrafo ou pluma, preferiblemente azul. Non se permitirá a entrega destas probas a lapis ou a bolígrafo vermello.

Non se permitirá, en todas as probas, ben consideradas de avaliación continua ou exame final, o uso de dispositivos electrónicos tales como tablet, smartphone, portátil, etc.

Compromiso ético.

Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, etc.), considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Nese caso, a cualificación global no presente curso académico será de suspenso (0.0).

Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula de exame será considerado motivo de non superación

da materia no presente curso académico e a cualificación global será de suspenso (0.0).

Bibliografía. Fontes de información

Basic Bibliography

Çengel, Yunus y Boles, Michael, **Termodinámica**, 7ª Edición, McGraw-Hill, 2012

Çengel Yunus A., Boles Michael A., **Thermodynamics : an engineering approach**, 7th ed, McGraw-Hill, 2011

Çengel Y.A., y Ghajar A.J., **Transferencia de Calor y Masa. fundamentos y aplicaciones**, 4ª edición, McGraw-Hill, 2011

Çengel, Yunus A., **Heat and mass transfer: a practical approach**, 4th ed, McGraw-Hill, 2011

Complementary Bibliography

Çengel Y.A., **Introduction to Thermodynamics and Heat Transfer**, McGraw-Hill, 2008

Moran M.J. y Shapiro H.N., **Fundamentos de Termodinámica Técnica**, 2ª edición - castellano, Ed. Reverté, 2004

Merle C. Porter y Craig W. Somerton, **Termodinámica para ingenieros**, McGraw-Hill/Interamericana de España, 2004

Incropera F.P. y DeWitt D.P, **Introduction to Heat Transfer**, 2002

Wark, K. y Richards, D.E., **Termodinámica**, McGraw-Hill, 2010

Kreith J. y Bohn M.S, **Principios de Transferencia de Calor**, 2001,

Mills A.F., **Transferencia de calor**, 1995

Recomendacións

Subjects that it is recommended to have taken before

Física: Física II/V12G340V01202
Matemáticas: Cálculo I/V12G340V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G340V01204

Other comments

Para matricularse nesta materia será necesario ter superado ou estar matriculado de todas as materias de cursos inferiores ao curso no que está emprazada esta materia

Dada a limitación de tempo da materia Termodinámica e Transmisión de Calor, recoméndase que o alumno supere a materia Física II de 1º Curso ou que teña os coñecementos dos Principios de la Termodinámica equivalentes.

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
SEN CAMBIOS

* Metodoloxías docentes que se modifican
Caso de chegar a suspender a presencialidade nas aulas, as metodoloxías docentes (lección maxistral, seminarios, clases de problemas, traballos tutelados, presentacións, etc) realizaranse a través dos medios virtuais que a Universidade de Vigo poña a disposición do profesorado para tal efecto.

* Mecanismo non presencial de atención ao alumnado (*tutorías)
A atención ao alumnado en *tutorías realizarase en horario fixado e publicado das titorías pero a través de "cita previa" xestionada por email. Desta maneira a titorización realizarase a través dos medios virtuais que a Universidade de Vigo propoña e habilite ao profesorado para tal efecto, véxase despacho virtual do profesor en Campus Remoto

* Modificacións (si proceden) dos contidos a impartir
SEN CAMBIOS

* Bibliografía adicional para facilitar o auto-aprendizaxe

* Outras modificacións

=== ADAPTACIÓN DA AVALIACIÓN ===

En caso de existir unha situación de alarma sanitaria e por parte da autoridade competente (administracións sanitarias e a propia institución via Reitorado) decrétese a non presencialidade, é posible que parte dos contidos docentes avalíense mediante outras tarefas que terán un peso do 20%, o que fai que a avaliación do curso quede coas seguintes porcentaxes:

Proba "Exame de preguntas obxectivos" -> 20%

Proba "Resolución de problemas e/ou exercicios" -> 60%

"Tarefas adicionais" -> 20%

IDENTIFYING DATA				
Applied electrotechnics				
Subject	Applied electrotechnics			
Code	V12G360V01501			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Garrido Suárez, Carlos			
Lecturers	Garrido Suárez, Carlos			
E-mail	garridos@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The objective of Applied Electrotechnic is to complete the training of the students of the Degree of Engineering in Industrial Technologies in what is related with Theory of Circuits and Electric Machines. This subject will provide them specific tools to analyse and evaluate the behaviour of the electric circuits in stable and transitory regime. The subject is conceived to provide the necessary knowledge and competencies to be able to be taught some subjects in the 3rd and 4rd years of the Degree. The students would have studied previously the subjects Basics of Theory of Circuits and Electric Machines and Calculus I and II because some of the information provided in these subjects will be necessary to follow, without and extra effort, Applied Electrotechnic			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE22	CE22 Applied knowledge of electrical engineering
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT10	CT10 Self learning and work.
CT14	CT14 Creativity.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
To understand the behaviour of the electric circuits in case of a change of the working conditions	CG3	CE22	CT1 CT2 CT6 CT10 CT14 CT17
To master the actual techniques for the analysis of 3-phase balanced and unbalanced electric circuits	CG3	CE22	CT1 CT2 CT6 CT10 CT14 CT17
To know the measurement and data register techniques in the real electric circuits	CG3	CE22	CT1 CT2 CT6 CT10 CT14 CT17
To acquire analysis skill to evaluate the cisruits working under fault conditions. These skills will be applied to the study of the electrical transformers.	CG3	CE22	CT1 CT2 CT6 CT10 CT14 CT17

Contents	
Topic	
UNIT I: 3-PHASE CIRCUITS, POWER MEASUREMENTS AND REACTIVE POWER COMPENSATION. This Unit will allow the student to understand how to analyse 3-phasecircuits under much balanced or unbalanced conditions Initially the unit covers the basic concepts for the analysis of balanced circuits. It continues covering unbalanced circuits, the different methods to measure the electrical powers and the compensation of reactive power.	□ Introduction: Generators, loads and 3-phase circuits □ Balanced 3-phase circuits. Voltages and currents. □ Conversion of 3-phase sources and loads. □ Analysis of balanced 3-phase circuits. □ Powers in balanced 3-phase circuits. Compensation. □ Analysis of unbalanced 3-phase circuits.
UNIT II: TRANSFORMERS This Unit will allow the student to learn about the constructive characteristics of the transformers, to determine his characteristic parameters and to understand the machine main properties and his utilization in the electric systems.	□ Analogies between electric and magnetic circuits. □ Introduction to the transformers: constructive aspects. □ The ideal transformer. □ Operation of the real transformer. □ Equivalent circuit of the single-phase transformer real: e.m.f's and voltages. □ No-load and in short-circuit tests of the transformer. □ Voltage drops , losses and performance of a transformer. □ Autotransformers. □ 3-phasetransformers: Constitution, conection diagrams and tests. □ Instrument transformers.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	9	9	18
Practices through ICT	9	9	18
Problem solving	9	18	27
Lecturing	20	60	80
Essay questions exam	7	0	7
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Laboratory practical	Experimental solving of of proposed lab tests, realization of measurements and presentation of results.
Practices through ICT	□ Simulación by means of computer programs of 3-phase circuits and transformers.
Problem solving	□ Students solving of proposed exercises. Personal guidance if required
Lecturing	The usual master lessons

Personalized assistance	
Methodologies	**Description**
Lecturing	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail.
Laboratory practical	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail.
Practices through ICT	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail.
Problem solving	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail.

Assessment			
	Description	Qualification	Evaluated Competencess

Essay questions exam	Continuous assessment (100%): At the end of each subject the student will perform a test that will be scored from 0 to 10 points. The passing grade is 5. The test will assess theoretical issues and practical exercises. In each test the student can reach 50% of the final grade. The passed partial tests are released from the corresponding part in the final exam. For students who pass all tests, the final grade will be the weighted average of the marks of the partial tests. Students who fail or fail to submit any or all partial tests, will take a final exam in the official exam that will be graded from 0 to 10 points. To pass the subject it is necessary to achieve a minimum grade of 3 points in each unit. The students approved by partial tests can modify the note and also present the final test. The examination will indicate the dates and places of publication of grades and revisions.	100	CG3 CE22	CT1 CT2 CT6 CT10 CT14 CT17

Other comments on the Evaluation

The student only has to take the failed partial in the July exam. The July final mark will be calculated equally as for the first final mark.

Sources of information

Basic Bibliography

Parra V.M., Ortega J., Pastor A. y Pérez-Coyto A, **Teoría de Circuitos**, UNED,

González E., Garrido C. y Cidrás J, **Ejercicios resueltos de circuitos eléctricos**, Tórculo Edicións,

Fraile Mora, Jesús, **Máquinas Eléctricas**, McGraw-Hill,

Jesús Fraile Mora y Jesús Fraile Ardanuy, **Problemas de Máquinas Eléctricas**, McGraw-Hill/InterAmericana de España,

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Electrical machines/V12G360V01605

Subjects that it is recommended to have taken before

Physics: Physics 2/V12G360V01202
Mathematics: Calculus 2 and differential equations/V12G360V01204
Basics of circuit analysis and electrical machines/V12G360V01302

Other comments

Requirements: To enrol in this subject is necessary to had surpassed or well be enrolled of all the subjects of the inferior courses to the course in the that is summoned this subject

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 case of virtual or mixed teaching, keep the same educational methodologies that in face-to-face teaching using the telematic means that the University puts to disposal of the teachers and students (Faitic, Campus Remoto, Campus Integra, computer programs)

* Teaching methodologies modified
The practices of laboratory substitute by tasks using computer programs of electrical simulation.

* Non-attendance mechanisms for student attention (tutoring)
The student attention (tutoring), in case of virtual or mixed teaching, will manage of telematic form by means of the use of the available telematic tools (Faitic, Campus Remoto and/or Campus Integra, e-mail, phone)

* Modifications (if applicable) of the contents
Any

* Additional bibliography to facilitate self-learning
Any

* Other modifications
Any

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
The face-to-face proofs made keep his value and weight in the global evaluation

* Pending tests that are maintained
The pending proofs to make are supported by his value and weight in the global evaluation, making through the distinct tools put to disposal of the teachers and students (faitic, email, Campus Remoto , Campus Integra, telephone, etc.)

* Tests that are modified
Any

* New tests
Any

* Additional Information
The criteria of evaluation are kept adapted to the realisation of the proofs, in the case to be necessary and by indication in Resolution Rectoral, using the telematic means places to disposal of the theachers

IDENTIFYING DATA				
Materials engineering				
Subject	Materials engineering			
Code	V12G360V01502			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Pérez Vázquez, María Consuelo			
Lecturers	Collazo Fernández, Antonio Gomez Barreiro, Silvia Pérez Vázquez, María Consuelo			
E-mail	mcperez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Nesta materia preténdese axuntar os fundamentos científicos que xustifican a relación entre estrutura, propiedades e comportamento, cos aspectos máis tecnolóxicos da forma en que esas interaccións mutuas ven afectadas polos procesos de elaboración e polas condicións de servizo.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
CG6	CG6 Capacity for handling specifications, regulations and mandatory standards.
CG11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
CE19	CE19 Knowledge and skills for engineering materials.
CT1	CT1 Analysis and synthesis.
CT5	CT5 Information Management.
CT7	CT7 Ability to organize and plan.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT15	CT15 Objectification, identification and organization.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
New	CG3	CE19	CT1
	CG4		CT5
	CG5		CT7
	CG6		CT9
	CG11		CT10
			CT15
			CT17

Contents
Topic

• Mechanical behaviour of the materials. • Answer of the materials subjected to processes of conformed by foundry, *moldeo and injection. • Answer of the materials subjected to processes of conformed by plastic deformation, *viscoelástica and *compactación of dusts. • Modification of materials by means of thermal treatments, *termoquímicos and *termomecánicos. • Technologies of the union and *soldabilidad. • Materials of construction. • Materials for tools.	.Materials under tensions plastic Deformation Conformed of sheet .*Moldeo And defects of *moldeo .*Fractografía
Parts of laboratory	Mechanical essays Essays no destructive electrochemical Essays

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	13	19	32
Mentored work	0	11	11
Seminars	3	3	6
Problem solving	4	8	12
Lecturing	33	56	89

*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	Activities of application of the *conocimentos and concrete situations and of the acquisition of basic skills and *procedimentales related with the matter *objecto of study. They develop in *aboratorios with skilled equipment.
Mentored work	The student, of individual way or in group, elaborates a document on the thematic of the matter or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc.
Seminars	It pretends do *unseguimiento of the work of the student, as well as resolve the *dificulatades that find in the understanding of the contents of the *asigantura.
Problem solving	Activity in which the professor proposes to the students a series of problems and/or exercises related with the *asignatura, so that it work on them home. The student has to develop the suitable or correct solutions by means of the realisation of routines, the application of formulas or algorithms, the application of procedures of transformation of the available information and the interpretation of the results. The resolution of the problems will do in class, by part of the professor or of some student.
Lecturing	Oral and direct exhibition, by part of the professor, of the corresponding fundamental knowledges to the subjects of the *asignatura in question.

Personalized assistance

Methodologies	Description
Mentored work	
Seminars	

Assessment

	Description	Qualification	Evaluated Competencess	
Laboratory practical	The formative activities of practical character will evaluate according to the criteria of assistance and degree of participation, reports of development of practices or of visits to companies (individual or by groups)	15		CT5 CT9 CT10 CT15 CT17
Mentored work	They will evaluate by the reports presented, and the exhibition in class of the works.	15	CG3 CG4 CG11	CT9 CT10 CT15 CT17

Lecturing	It will realise by means of a proof written (short questions and type test) that collect the knowledges purchased by the student along the course.	70	CG3 CG4 CG5 CG6 CG11	CT5 CT7 CT9 CT10 CT15

Other comments on the Evaluation

Sources of information

Basic Bibliography

Kalpakjian, S. y Schmid, S. R.,, **Manufactura, Ingeniería y Tecnología**, Pearson Educación,

Mikell P. Groover, **Fundamentos de Manufactura Moderna: Materiales, Procesos y Sistemas**, Prentice Hall, Hispanoamericana, S.A,

G. E. DIETER, **MECHANICAL METALURGY**, McGraw-Hill Book Company,

Complementary Bibliography

Manuel Reina Gómez, **Soldadura de los aceros, aplicaciones.**, Gráficas Lormo,

Sindo Kou, **Welding Metallurgy**, John Wiley & Sons,

GEORGE KRAUSS, **STEELS: Heat Treatment and Processing Principles**, ASM International,

BROOKS, CH., **Principles of the Surface Treatment of Steels.**, Inc. Lancaster,

M. G. RANDALL, **Sintering: Theory and Practice**, John Wiley & Sons,

P. Beeley, **Foundry Tecnology**, Butterworth-Heineman, Ltd.,

Recommendations

Subjects that continue the syllabus

Materials and technologies in mechanical manufacturing/V12G380V01912
Materials selection, tools and manufacturing resources/V12G380V01932
Fluidmechanic systems and advanced materials for transportation/V12G380V01942

Subjects that it is recommended to have taken before

Materials science and technology/V12G380V01301

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				
Physics 3				
Subject	Physics 3			
Code	V12G360V01503			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	López Vázquez, José Carlos			
Lecturers	Fernández Fernández, José Luís López Vázquez, José Carlos			
E-mail	jclopez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The main goals of Physics III are: a) To get a deeper understanding of the physical foundations of engineering, specifically those related to electromagnetic and wave phenomena. b) To introduce the use of mathematical tools, in particular vector analysis and differential equations and their associated boundary value problems, within the framework of problems and models in Physics. c) To combine theoretical education and a practical engineering approach, stressing the relevance of fundamentals to deal with problem analysis and synthesis of solutions in real-life situations. d) To relate the topics in the fundamentals of electromagnetism and wave phenomena to the contents of other more technological subjects included in the curriculum for the Degree. The topics of Physics III are, essentially, an introduction to wave phenomena in general (three units) and the study of classical electromagnetism using an axiomatic approach employing a mathematical treatment based on differential vector operators (four units).			

Competencies	
Code	
CG10	CG10 Ability to work in a multidisciplinary and multilingual environment.
CE2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
To know and to understand the physical foundations of electricity and magnetism as well as of vibrations and waves.	CG10	CE2	
To know and to be able to apply, in simple cases, vector analysis and differential equations of mathematical physics, as problem solving tools within the framework of fundamentals of physics.	CG10	CE2	
To be able to establish efficient strategies and procedures for solving problems in fundamentals of physics related to industrial technologies.	CG10	CE2	
To be able to implement specific solutions in the laboratory to experimental problems in fundamentals of physics.	CG10	CE2	CT10

Contents	
Topic	
I.1. WAVE MOTION	1.1. Wave phenomena 1.2. Fundamental characteristics of waves 1.3. The wave equation 1.4. Plane waves 1.5. Wavefront and wavevector 1.6. Cylindrical and spherical waves 1.7. Longitudinal and transverse waves 1.8. Huygens' principle 1.9. Reflection and refraction of waves

I.2. MECHANICAL WAVES	2.1. The nature of mechanical waves 2.2. Longitudinal waves in thin rods 2.3. Longitudinal waves in springs 2.4. Transverse waves in strings 2.5. Power flow and intensity of a wave 2.6. Longitudinal waves in fluids
I.3. DESCRIPTION OF PHYSICAL QUANTITIES BY MEANS OF VECTOR ANALYSIS	3.1. Differential of arc of a curve 3.2. Scalar fields 3.3. Directional derivative 3.4. Gradient 3.5. Vector fields 3.6. Flux of a vector field 3.7. Solenoidal fields 3.8. Divergence of a vector field 3.9. Ostrogradski-Gauss' theorem or divergence theorem 3.10. Divergence of a solenoidal field 3.11. Circulation of a vector field 3.12. Rotation or curl of a vector field 3.13. Stokes' theorem 3.14. Conservative fields
II.1. GENERAL EQUATIONS OF ELECTROMAGNETISM	1.1. Definition of electric and magnetic fields 1.2. Field sources: macroscopic electric charges and currents 1.3. Relations among fields E and B and their sources: Maxwell's equations 1.4. Free charge 1.5. Polarization charge 1.6. Electric current 1.7. Polarization current 1.8. Magnetization current 1.9. Maxwell's equations as a function of fields E, D, B, and H 1.10. Boundary conditions for electromagnetic fields 1.11. Electrodynamic potentials 1.12. The energy law of the electromagnetic field
II.2. TIME-INDEPENDENT FIELDS: ELECTROSTATICS, STEADY ELECTRIC CURRENT AND MAGNETOSTATICS	2.1. Fundamental equations of electrostatics 2.2. Electric dipole 2.3. Fundamental equations for steady electric current 2.4. Equations including media properties 2.5. Electrical resistance 2.6. Joule's law 2.7. Electromotive forces and generators 2.8. Potential distribution in a resistor 2.9. Fundamental equations of magnetostatics 2.10. Equations including media properties 2.11. Magnetic forces 2.12. Magnetic circuit 2.13. Magnetic dipole
II.3. ELECTROMAGNETIC INDUCTION AND QUASISTATIC FIELDS	3.1. Electromagnetism in moving media 3.2. Galilean transformation of electric and magnetic fields 3.3. Electromotive force around a circuit 3.4. Faraday's law of electromagnetic induction 3.5. Definition of quasistatic fields 3.6. Self-inductance and mutual inductance 3.7. Magnetic energy
II.4. ELECTROMAGNETIC WAVES	4.1. Wave equations for fields E and H 4.2. E.M. monochromatic plane waves in lossless media 4.3. E.M. monochromatic plane waves in lossy media 4.4. Incidence of a plane wave on an interface between two perfect dielectrics 4.5. Incidence of a plane wave on an interface between a perfect dielectric and a conductor
III.1 LABS: STRUCTURED ACTIVITY SESSIONS	1.1 Structured activity sessions: - Experimental data processing (approximate quantities, measurement of physical magnitudes, error estimation) - Adequate operation with basic measurement instruments (flex-meter, micrometer, multimeter (analog and digital), oscilloscope) - Laboratory experiments with mechanical or electromagnetic waves (emission and reception of ultrasonic waves, microwaves or light waves, standing waves along one direction, Michelson interferometer)

III.2 LABS: UNSTRUCTURED ACTIVITY (OPEN LAB) SESSIONS	2.1. Unstructured activity (open lab) sessions: - A practical problem, formulated with basic initial data, will be assigned to each working team. Then, under the teacher's supervision, each team must analyze the problem, select a possible solution and carry it out in the lab - For the open lab problems, a diversity of topics and experimental techniques are considered within the field of wave and electromagnetic phenomena, in particular, electric current conduction and electromagnetic induction in quasi-static regime - As a reference, some open lab problems that can be proposed are: measuring the electric field on a weakly conducting sheet, numerical solution of the Laplace equation, measuring the self-inductance of a coil or a solenoid, measuring the mutual inductance of two coils or two solenoids - As an option, the open lab session may be replaced by a well-documented piece of work reporting some topic/technique/process/device related to science or technology where wave or electromagnetic phenomena play an essential role. The report must include a model of the problem, clearly identifying the relevant quantities and physical laws

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	30	50
Problem solving	11.5	30.5	42
Laboratory practical	18	18	36
Essay questions exam	2	0	2
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	18	18

*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 main topics of the subject are introduced by the teacher using projected presentations and the chalkboard, emphasizing the theoretical basis and fundamentals and stressing the critical or key points. Occasionally, demonstrative experiments or audiovisual material may be employed
Problem solving	Academic problems related to the topics of the subject are formulated and worked out at the chalkboard by the teacher or the students. By practicing standard schemes, formulas or algorithms and by analyzing the results, the student must develop adequate skills to be able to obtain the correct solution to the problem on his/her own at the end of the course
Laboratory practical	Activities for applying the knowledge to particular situations and for developing basic and procedural skills related to the subject. These activities will be held in specific rooms with specialized equipment (laboratory and computer rooms)

Personalized assistance

Methodologies	Description
Lecturing	In tutoring hours
Laboratory practical	In tutoring hours
Problem solving	In tutoring hours

Assessment

	Description	Qualification	Evaluated Competencess		
Essay questions exam	Test that includes open questions on a topic. Students should develop, relate, organize and present knowledge on the subject in an argued response	50	CG10	CE2	
Problem and/or exercise solving	Test in which the student must solve a series of problems and/or exercises in a time/conditions set by the teacher	40	CG10	CE2	CT10
Report of practices, practicum and external practices	Each team should write a report on the activities carried out. The report must include the tasks and procedures developed, the results obtained or the observations taken, as well as a detailed description of the data processing and analysis	10	CG10	CE2	CT10

Other comments on the Evaluation

1. CONTINUOUS ASSESSMENT

CONTINUOUS ASSESSMENT TESTS (40%)

- Mark A0 (20%) will be obtained from essay-questions exams on topics of Parts I and II

- Mark L0 (20%) will be obtained from a problem-solving exam on topics of Part III.1 (10%) and from the open lab report (or the topic report) corresponding to Part III.2 (10%). Only students that have regularly attended the lab sessions can obtain mark L0

FINAL EXAM (60%)

- To be held in the December-January call

- Mark T1 (30%) will be obtained from an essay-questions exam on topics of Parts I and II

- Mark P1 (30%) will be obtained from a problem-solving exam on topics of Parts I and II

GLOBAL MARK

- The global mark G1 is obtained as

$$G1 = T1 + P1 + L0 + A0$$

- To pass the course, a student must obtain a global mark G1 equal to or higher than 5

2. END-OF-TERM ASSESSMENT

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- To be held on the same date as the final exam in the December-January call

- Mark A1 (20%) will be obtained from essay-questions exams on topics of Parts I and II

- Mark L1 (20%) will be obtained from a problem-solving exam on topics of Part III.1

GLOBAL MARK

- In this case the global mark G1 is obtained as

$$G1 = T1 + P1 + L1 + A1$$

- To pass the course, a student must obtain a global mark G1 equal to or higher than 5

- A student that has previously obtained marks L0 or A0 (or both) can choose between:

a) answering the exam(s) corresponding to mark L1 and/or mark A1, in such a way that the new mark L1 replaces L0 and/or the new mark A1 replaces A0

b) maintaining mark L0 and/or mark A0 instead of taking the exam(s) corresponding to mark L1 and/or mark A1, respectively

3. ASSESSMENT IN THE SECOND CALL (JUNE-JULY)

FINAL EXAM (60%)

- To be held in the June-July call

- Mark T2 (30%) will be obtained from an essay-questions exam on topics of Parts I and II

- Mark P2 (30%) will be obtained from a problem-solving exam on topics of Parts I and II

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- To be held on the same date as the final exam in the June-July call

- Mark A2 (20%) will be obtained from essay-questions exams on topics of Parts I and II

- Mark L2 (20%) will be obtained from a problem-solving exam on topics of Part III.1

GLOBAL MARK

- In this case the global mark G2 is obtained as

$$G2 = T2 + P2 + L2 + A2$$

- To pass the course, a student must obtain a global mark G2 equal to or higher than 5

- A student that has previously obtained marks L0, L1, A0 or A1 can choose between:

a) answering the exam(s) corresponding to mark L2 and/or mark A2, in such a way that the new mark L2 and/or the new mark A2 will replace the marks of the same type (L0 or L1 and/or A0 or A1, respectively)

b) maintaining the most recent marks of each type (L0 or L1 and/or A0 or A1) instead of taking the exam(s) corresponding to mark L2 and/or mark A2, respectively

4. NOTATION FOR MARKS

- L = the latest mark from L0, L1 and L2

- A = the latest mark from A0, A1 and A2

- T = T1 in December-January call (1st edition) or T2 in June-July call (2nd edition)

- P = P1 in December-January call (1st edition) or P2 in June-July call (2nd edition)

- G = G1 in December-January call (1st edition) or G2 in June-July call (2nd edition)

- In either of the calls the global mark G is obtained as

$$G = T + P + L + A$$

- To pass the course, a student must obtain a global mark G equal to or higher than 5

5. SUPPLEMENTARY ASSESSMENT RULES

- Presentation of DNI or any other identification document is compulsory during tests and exams

- Students should not have access to or use any electronic device during the tests and exams, unless specifically authorised. The mere fact of taking an unauthorised electronic device into the examination room will result in the student failing the subject in the present academic year and the global mark will be "suspenso (0.0)"

- The tests and exams will be jointly set and assessed by the teaching team of the subject

- The global mark for students not attending the final exam will be "non presentado"

- The dates for the final exams at each call will be assigned by the board of directors of the School of Industrial Engineering (E.E.I.)

- The exams corresponding to the end-of-degree call, as well as any exam held on dates and times other than those stated by the E.E.I. for official exams, could have a different format from the one described above. Nevertheless, each mark (L, A, T and P) will hold its value to calculate the global mark G

- The date and times for the revision (of marks and the results of tests and exams) will be announced in advance. Revision at any other time will be possible only if a justifiable reason for non-attendance is documented

6. ETHICAL COMMITMENT

Every student is expected to behave in an appropriate ethical manner. Should unethical conduct be detected (copying, plagiarism, utilisation of unauthorised electronic devices, or others), the student will be considered not to have fulfilled the necessary requirements to pass the subject. In this case, the global mark in the present academic year will be "suspenso (0.0)"

Sources of information

Basic Bibliography

J. L. Fernández, M. J. Pérez-Amor, **Guía para la resolución de problemas de electromagnetismo. Compendio de teoría**, Reverté, 2012

J. L. Fernández, M. J. Pérez-Amor, **Guía para la resolución de problemas de electromagnetismo. Problemas resueltos**, Reverté, 2012

M. Alonso y E. J. Finn, **Física**, Addison-Wesley Iberoamericana, 2000

M. Alonso and E. J. Finn, **Physics**, Pearson, 1992

Complementary Bibliography

M. R. Spiegel, **Análisis vectorial**, McGraw-Hill, serie Schaum, 2011

M. R. Spiegel, **Schaum's Outline of Vector Analysis**, McGraw-Hill, Schaum's Outline Series, 2009

D. K. Cheng, **Fundamentos de electromagnetismo para ingeniería**, Addison-Wesley, 1997

D. K. Cheng, **Fundamentals of Engineering Electromagnetics**, Prentice Hall 1993, Pearson 2014,

J. A. Edminister, **Electromagnetismo**, McGraw-Hill, serie Schaum, 1992

J. A. Edminister, M. Nahvi, **Schaum's Outline of Electromagnetics**, McGraw-Hill, Schaum's Outline Series, 2013

I. Bronshtein, **Manual de matemáticas para ingenieros y estudiantes**, MIR 1982, MIR-Rubiños 1993,

I. N. Bronshtein, K. A. Semendyayeb, **Handbook of Mathematics**, Springer, 2007

M. R. Spiegel, **Fórmulas y tablas de matemática aplicada**, McGraw-Hill, serie Schaum, 2014

M. R. Spiegel, S. Lipschutz, J. Liu, **Schaum's Outline of Mathematical Handbook of Formulas and Tables**, McGraw-Hill, Schaum's Outline Series, 2011

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Algebra and statistics/V12G360V01103
Mathematics: Calculus 1/V12G360V01104
Mathematics: Calculus 2 and differential equations/V12G360V01204

Other comments

Requirements: To register in this subject, it is mandatory to have been registered or to be registered in all the subjects corresponding to the first and second years of the curriculum of the Degree in Industrial Technologies Engineering

In particular, it is highly recommended to have reviewed the topics in Physics and Mathematics included within the subjects that should have been passed previously

In the event of discrepancy, the Spanish version of this syllabus prevails

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo has established an extraordinary plan that will be activated when the administrations and the institution itself so determine, considering safety, health and responsibility criteria to ensure continued distance and blended learning. These already planned measures will guarantee, when required, the development of teaching in a more agile and effective way, as students and teachers will be made aware in advance (or well in advance) through the official channel of the syllabus document.

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

* Teaching methodologies modified
All the methodologies (lecturing, problem solving and laboratory practical): in the blended learning regime face-to-face classroom activities will be combined with on-line lecturing through the virtual campus (□Campus Remoto□), using the learning platform as an additional support. In the distance learning regime only online lecturing will take place through the virtual campus (□Campus Remoto□), using the learning platform as an additional support. To guarantee student access to the materials and resources of the course, other methodologies and media may be implemented if needed.

In particular, for the laboratory practical in the blended learning regime the operation of experimental devices by the students and the associated data acquisition activities could suffer major restrictions (due to the reduced capacity of the laboratory classroom, the mandatory use of personal protective equipment, the implementation of special hygiene measures and other factors). For these reasons, these activities will be mostly replaced by demonstrations developed by the lecturer in

a face-to-face session with some of the students from the laboratory group. These demonstrations will be followed online by the rest of the students from the same group. Data processing and analysis are highly independent from the operation of experimental devices and can be undertaken outside of the laboratory classroom (in another classroom, at home, etc.). In the distance learning regime, the laboratory practical will be undertaken entirely online and the operation of experimental devices and data acquisition activities will be completely replaced by demonstrations by the lecturer that will be followed online by the students. These demonstration could be complemented by other specific audiovisual materials.

* Non-attendance mechanisms for student attention (tutoring)
Tutoring hours could be held both face-to-face (provided that health and safety measures can be guaranteed using personal protective equipment) or online, by using asynchronous media (email, forum, etc.) or by making an appointment (videoconference).

* 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]
The weights of the tests for continuous assessment in the classroom (A-20%) and in the laboratory (L-20%) and the final theory (T-30%) and problems (P-30%) exams are kept unchanged. However, more flexibility could be introduced in the type of questions that can be employed in each part as detailed below.

Continuous assessment test, part A, weight 20%. Type of assessment: essay questions.
=>
Continuous assessment test, part A, weight 20%. Type of assessment: objective questions, problems and/or exercises solving, and essay questions.

Continuous assessment test, part L, weight 20%. Type of assessment: problems and/or exercises solving (10%) and report (10%).
=>
Continuous assessment test, part L, weight 20%. Type of assessment: problems and/or exercises solving and objective questions (10%), and report (10%).

Final exam, part P, weight 30%. Type of assessment: problems and/or exercises solving.
=>
Final exam, part P, weight 30%. Type of assessment: problems and/or exercises solving, and objective questions.

Final exam, part T, weight 30%. Type of assessment: essay questions.
=>
Final exam, part T, weight 30%. Type of assessment: objective questions and essay questions.

* New tests

* Additional Information

IDENTIFYING DATA				
Hydraulic turbomachines				
Subject	Hydraulic turbomachines			
Code	V12G360V01504			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Gil Pereira, Christian			
Lecturers	Gil Pereira, Christian			
E-mail	chgil@uvigo.es			
Web				
General description	The *asignatura *Turbomáquinas Hydraulic describes the operation of the group of machines that govern by the principle of Euler (machines *rotodinámicas). The knowledge of these machines provides the necessary basic principles to analyse the behaviour of the same in any installation in which they find , as well as the basic principles for his design and *dimensionado.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE8	CE8 Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering. Calculation of pipes, channels and fluid systems.
CE25	CE25 Applied knowledge of the basics of fluidmechanics systems and machines.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.

Learning outcomes		
Learning outcomes		Competences
□ Purchase skills on the process of *dimensionado of installations of pumping and machines of fluids	CG3	CE8 CE25 CT2 CT9 CT10
To understand basic aspects of hydraulic machines	CG3	CE8 CE25 CT2 CT9 CT10

Contents	
Topic	
1.- Introduction	1.- Machines of Fluids. Classification 2.- *Turbomáquinas Hydraulic 3.- Applications to the Industry 4.-Characteristic general
2.- Transfer of Energy	1.- Equation of conservation of the energy 2.- Application to *Turbomáquinas 3.- Adimensional parameters and coefficients of speed 4.-Performances
3.- Similarity and characteristic Curves	1.- Similarity in *turbomáquinas 2.- Practical utilisation of the laws of similarity 3.- Comparison between *turbomáquinas 4.- Characteristic curves in hydraulic bombs 5. Characteristic curves in hydraulic turbines 6. Adimensional coefficients. Specific speed and specific power
4.- Transfer of Work	1.- Fundamental equation of the *Turbomáquinas. Equation of Euler. Distinct expressions of the equation of Euler 2.- One-dimensional ideal theory of *TMH 3.- Two-dimensional ideal theory of *TMH 4.- Real flow. Losses 5.- *Cavitación In *TMH

5.- Machines of fluids of despicable compressibility	1.-Classification 2.- Fans. Characteristic curves 3.- *Aerogeneradores. Classification - Theory of the disk actuator. Limit of *Betz - basic Concepts of aerodynamic profiles - Theory of the element of shovel - Curves of power
6.- Machines of positive trip and hydraulic transmissions	1.- Types and classification 2.- Alternative and rotatory bombs. 3.- Hydraulic engines of positive trip 4.- Transmissions and hydraulic attachments
Practices	1. Introduction to the pneumatic systems: - Description detailed of the pneumatic systems and his components. -Basic circuits. -Resolution of problems proposed 2. Resolution problems of *TMH 3. *Turbomáquinas -Test characterisation turbine Francis 4. Resolution of problems of *MDP

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Laboratory practical	6	7	13
Problem solving	12	18	30
Essay questions exam	3	0	3
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	Exhibition of the theory *Traslación of technical problems to mathematical models.
Laboratory practical	Practices of pneumatic (see description in contents) Practices of *TH (see description in contents)
Problem solving	Technicians of design and calculation Presentation and interpretation of solutions.Practical cases

Personalized assistance

Methodologies	Description
Problem solving	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.
Lecturing	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.
Laboratory practical	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.

Assessment

	Description	Qualification	Evaluated	Competencess	
Essay questions exam	Proof written that it will be able to consist of: - theoretical Questions - practical Questions - Resolution of exercises/problems - Subject to develop	80	CG3	CE8 CE25	CT2 CT9 CT10
Problem and/or exercise solving	Resolution of exercises proposed, including: -*Memoría/exercises proposed of practices	20	CG3	CE8 CE25	CT2 CT9 CT10

Other comments on the Evaluation

Continuous evaluation: it will have a final weight of 30% of the final note of the *asignatura. 20% will consist in the resolution of exercises proposed. 10% to the active assistance to classThe note of continuous evaluation will not save of a course for another neither for the announcement of Julio.Tofinal Examination of the *asignatura (first announcement):&*nbsp;it will have a final weight of 70% of the final note of the *asignatura. It will consist, as it indicates in the previous section of&*nbsp;Proof written that it will be able to consist of: - theoretical Questions - practical Questions - Resolution of exercises/problems - Subject to develop so much of the classes of theory as of the classes of practices.Second announcement of Julio: it will consist in a final examination that represents 100% of the note of the *asignatura.Expects that the present student a suitable ethical behaviour. In
case to detect a no ethical behaviour (copy, plagiarism, utilisation of unauthorised
electronic devices, for example) will consider that the student does not gather the necessary requirements to surpass the matter. In this case the global
qualification in the present academic course will be of suspense (0.0).

It will not allow the utilisation of any electronic device during the *probas of
evaluation except permission expresses. The fact to enter an unauthorised
electronic device in the classroom of examination will be considered reason of no *superación of the matter in the present academic course and the global qualification will be
of suspense (0.0).

Sources of information

Basic Bibliography

Viedma A., Zamora B., **Teoría y Problemas de máquinas hidráulicas**, 3º Ed., Horacio Escarabajal Editores., 2008

Mataix, C., **Turbomáquinas Hidráulicas**, Editorial ICAI, 1975

Mataix, C., **Mecánica de Fluidos y Máquinas Hidráulicas**, Editorial del Castillo S.A., 1986

Complementary Bibliography

Hernández Krahe, J. M, **Mecánica de Fluidos y Máquinas Hidráulicas.**, UNED, 1998

Krivchenko, G, **Hydraulic Machines: Turbines and Pumps**, 2ª ed., Lewis, 1994

Creus, A., **Neumática e Hidráulica.**, Marcombo Ed., 2011

Karassik, I. J., **Pump Handbook**, 2ª ed., Nueva York, McGraw-Hill., 1986

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Calculus 2 and differential equations/V12G360V01204
Fluid mechanics/V12G360V01403

Other comments

To enrol in this matter is necessary to have surpassed or be enrolled of all the matters of the inferior courses to the course in which it finds this matter.

In case of discrepancies, will prevail the version in Spanish of this guide.

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 keep
- Lesson *magistral and Resolution of problems: they will make of telematic form

* educational Methodologies that modify
- Practical of laboratory: they will substitute by videos and explanatory documents that will allow to complete the tasks proposed

* Mechanism no face-to-face of attention to the students (*tutorías)
- The *tutorías will make through Remote Campus in the dispatch assigned

* Other modifications

=== ADAPTATION OF THE EVALUATION ===

* Test that they keep
- The proofs will make of telematic form keeping the contents, weights and criteria of evaluation

IDENTIFYING DATA				
Matemáticas da especialidade				
Subject	Matemáticas da especialidade			
Code	V12G360V01505			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3	1c
Teaching language				
Department	Matemática aplicada I			
Coordinator	Vidal Vázquez, Ricardo			
Lecturers	Vidal Vázquez, Ricardo			
E-mail	rvidal@uvigo.es			
Web				
General description				

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CT1	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.

Resultados de aprendizaxe		
Learning outcomes		Competences
Proporcionar os coñecementos básicos sobre variable complexa, análise de *Fourier e Transformadas integrais, ampliación e tratamento numérico de ecuacións diferenciais e técnicas de resolución de ecuacións non lineais	CG3	CT1 CT2
Aplicar os coñecementos básicos sobre variable complexa, análise de *Fourier e Transformadas integrais, ampliación e tratamento numérico de ecuacións diferenciais e técnicas de resolución de ecuacións non lineais para resolver problemas técnicos	CG3	CT1 CT2

Contidos	
Topic	
Tema 1. Resolución de ecuacións non lineais	1. Métodos directos, de bisección e de punto fixo. 2. Métodos de linealización.
Tema 2. Ampliación de ecuacións diferenciais	1. Métodos numéricos de Euler e Runge-Kutta.
Tema 3. Variable complexa	1. O corpo dos números complexos 2.Funcións holomorfas 3. Integración complexa 4. Series de potencias 5. Series de Laurent 6.Teorema de los residuos 7. Transformada z
Tema 4. Análise de Fourier e Transformadas integrais	1. Espazos con produto escalar 2. Sistemas ortonormales completos 3. Series de Fourier trigonométricas 4. Problemas de Sturm-Liouville 5. Transformada de Fourier 6. Transformada de Laplace 7. Aplicacións

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	31	62	93
Prácticas con apoio das TIC	18	27	45
Exame de preguntas de desenvolvemento	3	3	6
Resolución de problemas e/ou exercicios	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Exposición da teoría. Translación de problemas técnicos a modelos matemáticos.
Prácticas con apoio das TIC	Técnicas de cálculo e programación, presentación e interpretación de solucións.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	O profesor atenderá persoalmente as dúbidas e preguntas do alumnado.
Prácticas con apoio das TIC	O profesor atenderá persoalmente as dúbidas e preguntas do alumnado.

Avaliación				
	Description	Qualification	Evaluated Competencess	
Exame de preguntas de desenvolvemento	Realizarase un exame final de resolución de problemas na aula informática onde se poderán utilizar os programas preparados polo alumno, sobre os contidos de toda a materia.	60	CG3	CT1 CT2
Resolución de problemas e/ou exercicios	Avaliación continua: Asistencia as clases teóricas e practicas. Presentación dunha worksheet en Sage cos traballos propostos ó alumno.	40	CG3	CT1 CT2

Other comments on the Evaluation

Para os alumnos que renuncien á avaliación continua o exame final suporá o 100% da nota.

A avaliación dos alumnos en segunda convocatoria consistirá nun exame sobre os contidos da totalidade da materia, que suporá o 100% da nota.

COMPROMISO ÉTICO:

"Esperase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamiento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) se considerará que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a calificación global no presente curso académico será de suspenso (0.0)."

Bibliografía. Fontes de información

Basic Bibliography

E. Corbacho, **Matemáticas de la Especialidad**, Curso 2014-2015,

F. De Arriba, E. Corbacho, MC. Somoza, R. Vidal, **Implementación e desenvolvemento de aulas de matemáticas avanzadas en Sage**, 978-84-8158-796-8, Servizo de Publicacións da Universidade de Vigo, 2018

F. De Arriba, A. Castejón, E. Corbacho, MC. Somoza, R. Vidal, **Implementacióne e desenvolvemento de aulas de xeometría euclídea e diferencial en Sage**, 978-84-8158-845-3, Servizo de Publicacións da Universidade de Vigo, 2020

M.R. Spiegel, **Análisis de Fourier. Teoría y problemas**,

M. Crouzeix , A.L. Mignot, **Analyse numérique des équations différentielles**,

Complementary Bibliography

P.G. Ciarlet, **Introduction à l'analyse numérique matricielle et à l'optimisation**,

H. Rinhard, **Éléments de mathematiques du signal**,

D.G Zill, **Ecuaciones diferenciales con aplicaciones de modelado**,

Recomendacións

Subjects that it is recommended to have taken before

Matemáticas: Álxebra e estatística/V12G360V01103
Matemáticas: Cálculo I/V12G360V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G360V01204

Other comments

Requisitos:

Para matricularse nesta materia é necesario superar ou ben estar matriculado de todas as materias dos cursos inferiores ao curso no que está situada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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 ===
Se a situación sanitaria o requiere,
- A actividade docente realizaráse a través de Campus Remoto, utilizando tamén a plataforma de teledocencia FAITIC como reforzo, todo elo sen perxuicio de poder utilizar medidas complementarias que garanticen a accesibilidade dos

IDENTIFYING DATA				
Machine design and testing				
Subject	Machine design and testing			
Code	V12G360V01602			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Yáñez Alfonso, Pablo			
Lecturers	Fernández Álvarez, José Manuel Yáñez Alfonso, Pablo			
E-mail	pyanez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This subject is intended to allow the students to apply the fundamentals of Mechanism and Machines Theory to the design of machines as well as the necessary knowledge, comprehension, and application of these concepts concerning to the field of Mechanical engineering. It also provides the students with the most important concepts related to the design of machines. The students will know and apply analysis methods for the design of machines by applying analytical methods or/and through the effective use of simulation software.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
CG6	CG6 Capacity for handling specifications, regulations and mandatory standards.
CG11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
CE13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
CE26	CE26 Knowledge and abilities to calculate, design and test machines.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT16	CT16 Critical thinking.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes	Competences		
Knowledge of calculation methods applied in Mechanical design.	CG3 CG4 CG5	CE13 CE26	CT2 CT9 CT16
Knowledge and design capabilities applied in mechanical power transmissions.	CG6	CE13 CE26	CT2 CT9 CT16 CT20
Knowledge of the fundamental laws applied in the study of machine elements.	CG11	CE13 CE26	CT2 CT9 CT16 CT20
Calculation capabilities and analysis applied for different machine components.	CG3 CG11	CE13 CE26	CT2 CT9 CT16

Contents	
Topic	
Mechanical design	1. Design vs. static loads 2. Design vs. dynamic loads

Power Transmissions	3. Introduction to power transmission systems 4. Gears (spur, bevel, and worm gears) 5. Axles and shafts
Machine elements	6. Clutches and brakes 7. Bolted joints and power screws 8. Plain and ball bearings

Planning			
	Class hours	Hours outside the classroom	Total hours
Problem solving	9	30	39
Laboratory practical	18	47	65
Lecturing	23	19.5	42.5
Problem and/or exercise solving	5.5	0	5.5
Problem and/or exercise solving	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Problem solving	Discussion of exercises
Laboratory practical	Practical sessions including specific material and software tools.
Lecturing	Lectures about the topics of the subject

Personalized assistance	
Methodologies	**Description**
Laboratory practical	There is only one practice group available for the classes held in English, so students must attend to their assigned group

Assessment					
	Description	Qualification	Evaluated Competencess		
Laboratory practical	Attendance and participation as well as practices reports, papers, and tests will be rated. However, to be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points. Learning outcomes: all will be graded	20		CE13 CE26	CT2 CT9 CT16 CT20
Problem and/or exercise solving	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded	60	CG3 CG4 CG5 CG6	CE13 CE26	CT2 CT9 CT16
Problem and/or exercise solving	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded	20	CG11	CE13 CE26	CT9 CT16

Other comments on the Evaluation

Students must achieve at least 5 points (out of 10 points) to pass the subject, according the following rules:

1. Students are required to attend and utilized the laboratory/Computer room.Practices reports, papers, and tests for each practice session as well as proposed works/papers from tutorials will be evaluated and graded with a maximum of 2 points of the final grade. This grade will be kept for the second term in the student's evaluation records (July). To be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.
2. For those students who have been officially granted the right to waive their continued evaluation, there will be a mandatory final test where they will be able to get a maximum grade of 2 points. However, an advanced request must be made to the professor to prepare the necessary materials for this test.
3. The final test will consist in short answer questions and problems, where the distribution of 20% and 60% of the final grade is simply an indicative percentage, depending on each examination sitting. The final test will have a maximum grade of 8 points.

* Grades are calculated using a system of numerical qualification from 0 to 10 points conforming to the Spanish current legislation (RD 1125/2003, 5 September; BOE 18 September).

Ethical commitment: An adequate ethical behaviour of the student is expected at all times. In case an unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, and others); the student will be considered unfit to meet the necessary requirements to pass the subject. In this case, the overall qualification in the current academic year will be a Fail grade (0.0).

The use of any electronic devices during tests is completely forbidden unless is specified and authorized. The fact of introducing unauthorized electronic devices in the examination room will be considered reason enough to fail the subject in the current academic year and the overall qualification will be a Fail grade (0.0).

Sources of information

Basic Bibliography

Norton, R., **Machine Design. An Integrated Approach**, Pearson, 2012

Shigley, J.E, **Mechanical Engineering Design**, 9ª edición, Mc Graw Hill, 2012

Norton, R., **Diseño de Máquinas. Un Enfoque Integrado**, Pearson, 2012

Shigley, J.E, **Diseño de en Ingeniería Mecánica**, 9ª edición, Mc Graw Hill, 2012

Complementary Bibliography

Mott, Robert L., **Machine Elements in Mechanical Design**, Pearson, 2006

Lombard, M, **Solidworks 2013 Bible**, Wiley, 2013

Hamrock, Bernard J, et al., **Fundamental Machine Elements**, Mc Graw Hill, 2000

Mott, Robert L., **Diseño de elementos de máquinas**, Pearson, 2006

Hamrock, Bernard J, et al., **Elementos de Máquinas**, Mc Graw Hill, 2000

Recommendations

Subjects that it is recommended to have taken before

Materials science and technology/V12G360V01301
Mechanics of materials/V12G360V01404
Mechanism and machine theory/V12G360V01303

Other comments

Requirements: to enrol in this subject, it is mandatory to have passed or at least, to have been enrolled in all the subjects in previous years.
In case of discrepancies, the Spanish version of this guide prevails.

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.

In the event that attendance to classes become legally entirely or partially limited, the measures set on place will be:
1. To guarantee the necessary means, namely personal computer or internet access, to every enrolled student so they can follow the distance learning classes, appropriately. Therefore, to apply the appropriate solutions, any student who does not have any of these means should inform the course coordinator.
2. To inform students of the different measures adopted, the department will use the platform, Faitic. 3. On top of that, in the case of cancelation of face-to-face classes, the teaching guide will show the next modifications:
A. Competences. They will not be modified.
B. Learning outcomes. They will not be modified.
C. Contents. They will not be modified.
D. Planning. It will not be modified.
E. Methodology. It will be modified: Lecturing and Problem solving. They will require the employment of electronic means (virtual classroom of the Remote Campus or others). Laboratory Practices. The department will provide every student access to CAD and FEM software, so that they can carry out the practices remotely instead of from the Mechanical Engineering laboratory. The professor will supervise these practices using electronic means (virtual classroom of the Remote Campus or others).
F. Tutoring Lessons. They will be carried out by previously arranged electronic means (e-mail, faitic forums or virtual classroom at campus remote,).

G. Assessment. Assessment methodologies/test will not be modified: Laboratory practical and Essay questions exam. Description, qualification, and competences, they will not be modified. All exams will use electronic means (virtual classroom of the Remote Campus or others); the department will publish in advance the specific rules for each test in the platform, Faitic. According to attendance at the virtual practice sessions, the professor will compute and validate each practice attendance on virtual classroom of the Remote Campus. Partial tests for the evaluation of specific contests of the subject can be proposed. Once again, the professor will publish in advance the rules concerning each test in the platform, Faitic.
H. Bibliography. Besides the bibliographical references found in this guide, the documentation provided at Faitic, and the problem bulletins and previous exams, the professor might facilitate additional notes, videos, web-references, and others, so that students can appropriately follow the course during the non-face-to-face classes.
This guide can be modified following Rectoral rules.

IDENTIFYING DATA				
Elasticity and additional topics in mechanics of materials				
Subject	Elasticity and additional topics in mechanics of materials			
Code	V12G360V01603			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Riveiro Rodríguez, Antonio			
Lecturers	Badaoui Fernández, Aida García González, Marcos Pérez Riveiro, Adrián Riveiro Rodríguez, Antonio			
E-mail	ariveiro@uvigo.es			
Web				
General description	This course will study the fundamentals of elasticity and deepen the study of mechanics of materials in order to be able to apply their knowledge to the actual behavior of solids (structures , machinery and resistant elements in general). This course, along with mechanics of materials course, is a holder of more specialized subjects whose object is the mechanical design.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE14	CE14 Knowledge and use of the principles of strength of materials.
CT2	CT2 Problems resolution.
CT5	CT5 Information Management.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
Knowledge of the foundations of the elasticity theory	CG3	CE14	
Further deepening on mechanics of materials and stress analysis	CG3 CG4	CE14	CT2 CT10
Knowledge of deformations in beams and shafts	CG3 CG4	CE14	CT2 CT9
Ability to apply the knowledge of elasticity and mechanics of materials, and to analyze the mechanical performance of machines, structures, and general structural elements	CG4	CE14	CT2 CT5 CT9
Ability to take decisions about suitable material, shape and dimensions for a structural element subjected to a specific load	CG4	CE14	CT2 CT5 CT9 CT17
Knowledge of different solving methods for structural problems and ability to choose the most suitable method for each specific problem	CG4	CE14	CT2 CT5 CT9

Contents
Topic

Fundamentals of elasticity	Introduction to the theory of elasticity Stress analysis of elastic solids Strain Stress-strain relationships Two-dimensional elasticity
Criteria of failure	Saint-Venant's failure criterion Tresca's failure criterion Von-Mises' failure criterion Safety coefficient
Bending	Non uniform bending: Shear stresses. Zhuravski expression Principal stresses. Stress trajectories Bending and axial load: Normal stresses. Neutral axis Eccentric axial loads Kern of the cross-section Beams of different materials
Bending. Statically indeterminate beams	General method Settlements in fixed supports Continuous beams Simplifications in symmetric and antisymmetric beams
Torsion	Definition Coulomb's fundamental theory Static torque diagrams Stress and angle of twist Statically indeterminate problems
Combined loads	Definition Bending and torsion loaded circular shafts Shear center Stress and strain calculation in plane-spatial structures
Strain energy and energy methods	Strain energy: Axial load/shearing loads/bending/torsion/general expression. Clapeyron's theorem Indirect and direct work Maxwell-Betti Reciprocal Theorem. Applications. Castigliano's theorem. Mohr's integrals. Applications. Principle of virtual works.
Trusses	Definition and general comments Degree of indeterminacy Analytical method of force calculation Pinned joint displacement determination External indeterminacy and internal indeterminacy
Structures with rigid joint connections	Definition Joint stiffness factor and distribution factor Degree of indeterminacy. Analysis by the stiffness method.
Moving loads	Influence lines. Definition and general properties.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Previous studies	0	6	6
Lecturing	13	26	39
Problem solving	18	22	40
Laboratory practical	18	4	22
Autonomous problem solving	0	15	15
Problem and/or exercise solving	2	17.5	19.5
Self-assessment	0	5	5
Laboratory practice	1	2	3

*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	Introduction to the subject: Course aims, expected learning outcomes, course syllabus, teaching methods, assessments and grading policy.

Previous studies	Student previous activities to lectures. The students will receive detailed instructions to complete and send certain exercises before lectures/laboratory sessions. The purpose of this assessment is to optimize the session outcome. The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide.
Lecturing	The contents of the subject will be presented in a organized way. Special emphasis will be put on the fundamentals of the subject and on the most troublesome points. To improve the comprehension, the contents of the next lectures will be announced on Tema platform on a weekly basis.
Problem solving	Each week will devote a time to the resolution by part of the student of exercises or problems proposed, related with the content studied in each moment.
Laboratory practical	Application of theory concepts to laboratory collaborative works.
Autonomous problem solving	The students will be supplied with exercises and problems to solve, the solutions will be provided for level self-evaluation.

Personalized assistance

Methodologies	Description
Autonomous problem solving	The lecturers are at disposal of the students during office hours to solve any question related to the subject contents. The students will be able to verify if the completed assignments are correct and to identify the mistakes of miscalculations. The detailed schedule will be provided to the students at the beginning of the course through the TEMA platform. Any modification will be previously announced.

Assessment

	Description	Qualification	Evaluated Competencess		
Previous studies	The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide. It shall be deemed completed when a previous activity fully answer all questions.	0			CT5 CT9 CT10 CT17
Laboratory practical	Attendance and active participation in the complete laboratory lessons and practice reports will be assessed. They will be graded from 0 to 10, provided that the student gets a minimum mark in the written examination (minimum mark: 4.5/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	5	CG4	CE14	CT2 CT5 CT9 CT10 CT17
Problem and/or exercise solving	Exam for the assessment of the module learning outcomes. The exam comprises of brief problems and/or theoretical questions. The duration and precise grading will be communicated at the beginning of the exam.	80	CG3 CG4	CE14	CT2 CT9
Laboratory practice	Short exercises and conceptual tests will be taken during the course (within lecture or laboratory hours; grading from 0 to 10). The mark will be added to the exam mark, provided that the student gets a minimum mark in the written examination (minimum mark: 4.0/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	15	CG3		CT9

Other comments on the Evaluation

In this module the minimum required mark to pass is 5 out of 10.

The written examination of students not able to attend laboratory sessions will be graded 100% of the module mark, provided the student resigns from continuous assessment (and gets the required school approval) within the period established for that purpose. This examination will assess the subject overall competencies.

The qualification obtained in the laboratory practices in any of the two previous years (5% of the qualification) will be

preserved in the current year, provided the student requests that within an established period in the beginning of the course.

The qualification obtained in the conceptual tests in any of the two previous years (15% of the qualification) will be preserved in the current year, provided the student requests that within an established period in the beginning of the course.The rating obtained only remain within the language chosen at the time in which he studied the subject.

Comments about continuous assessment:

The handing of previous exercises (within the established period for each exercise) will modify the qualification of laboratory practices and follow-up conceptual tests as following explained:

Qualification of laboratory practices = K□(overall practice grade)/(nr of laboratory sessions)

Qualification of conceptual tests = K □(addition of tests□ grades)/(nr of tests)

K = (nr of previous exercises delivered)/(total nr of previous exercises)

Additional comments:

The absence from a laboratory session, even justified, does not lead to the repetition of the session.

The absence from a test, even justified, does not lead to the repetition of the test.

The date and place of of examinations of all calls shall be determined by the center before the start of course and will make them public .

Ethical commitment: it is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Group responsible lecturer: Groups with teaching in Spanish: Marcos García González and Adrián Pérez Riveiro.

Group with teaching in English: Rafael Comesaña and Antonio Riveiro

Reading list for the group in English:

Recommended:

- Hibbeler R.C., Mechanics of Materials, SI Edition, Prentice Hall. 9th. edition

- José Antonio González Taboada , Tensiones y deformaciones en materiales elásticos, 2a Edición, Tórculo.

- José Antonio González Taboada , Fundamentos y problemas de tensiones y deformaciones en materiales elásticos, 1ª Edición, Tórculo.

Complementary:

- Timoshenko, Goodier, Theory of elasticity, 3rd ed., (International student ed.), McGraw-Hill

- Manuel Vázquez , Resistencia de Materiales.

Sources of information

Basic Bibliography

José Antonio González Taboada, **Tensiones y deformaciones en materiales elásticos**,

José Antonio González Taboada, **Fundamentos y problemas de tensiones y deformaciones en materiales elásticos**,

Manuel Vázquez, **Resistencia de Materiales**,

Complementary Bibliography

Luis Ortiz Berrocal, **Elasticidad**,

Robert Mott, Joseph A. Untener, **Applied Strength of Materials**, 6ª, CRC Press, 2016

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mechanics of materials/V12G360V01404

Other comments

To register for this module the student must have passed or be registered for all the modules of the previous years.

The original teaching guide is written in Spanish. In case of discrepancies, shall prevail Spanish version of this guide.

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on criteria of safety, health and responsibility , and guaranteeing teaching in a non-classroom or partially classroom setting. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way by being known in advance (or well in advance) by students and teachers through the standardized tool and institutionalized teaching guides.

=== ADAPTATION OF THE METHODOLOGIES ===

An attempt will be made to ensure that the degree of presentiality in teaching guarantees the safety and health of all parties involved. In any case, the guidelines will be followed in instructions indicated by the management of the center.
In the event that there is a situation in which the teaching activities cannot be attended, neither the content nor the learning results contemplated in the subject will be affected. To this end, the following adaptations will be made.

Theory sessions:

In the event that they cannot be attended, remote classrooms, video recordings of classes, or any other means enabled by the university will be used for delivery. The contents taught will be the same.

Laboratory sessions:
The carrying out of experimental practices will be replaced by non-contact activities to solve similar problems that may require the use of specific calculation / simulation software.

Tutorials:

For the situation of non-attendance, email and, if necessary, videoconference will be used.

Evaluation:

In the event that the tests cannot be carried out in person, they will be carried out by telematic means. The number of assessment tests will not change, nor will the relative weight of each one of them in the course grade.

IDENTIFYING DATA				
Manufacturing engineering				
Subject	Manufacturing engineering			
Code	V12G360V01604			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Pereira Domínguez, Alejandro			
Lecturers	Pereira Domínguez, Alejandro Pérez García, José Antonio			
E-mail	apereira@uvigo.es			
Web				
General description				

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE20	CE20 Applied knowledge of systems and manufacturing processes, metrology and quality control.
CT2	CT2 Problems resolution.
CT8	CT8 Decision making.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes			
Learning outcomes	Competences		
(*)	CG3	CE20	CT2 CT8 CT9 CT10 CT17 CT20

Contents	
Topic	
Thematic block I: Integration of Design of product and manufacture.	Chapter 0. Design of product and of process chapter 1. Systems of manufacture. Chapter 2. Technologies of additive manufacturing Chapter 3. Design of product for manufacturing (DFMA)
Thematic block II: Design and planning of processes of manufacture.	Chapter 4. Methodology of Design and Planning of processes of manufacture. Chapter 5. Choosing of operations, tools, toolings and conditions of process. chapter 6. Datums, fixturing and toolings. Chapter 7. Technicians of improvement of design and processes.
Thematic block III: Resources of the Systems of Manufacture.	Chapter 8. Machines tools with Numerical Controland components Chapter 9. Industrial robots and logistics devices. Systems of positioning, maintenance Chapter 10. Systems of measurement and verification in lines of manufacture. Definition of control charts

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2

Problem solving	18	16	34
Laboratory practical	18	0	18
Mentored work	0	60	60
Lecturing	14	14	28
Objective questions exam	2	0	2
Essay	2	0	2
Essay questions exam	2	2	4

*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	Introduction Objective theoretical topics practical topics Assestment Develop of projects. Desing and Develop Bibliographic Resources
Problem solving	Development of real practical cases and exercises on the following contents 1. Distribution in plant 2. Design of product / tooling 3. Application *DFMA 4. Application dimensional tolerances, geometrical and of superficial finishing 5. Design of operations of manufacture. 6. Conditions of process manufacturing. 7. Calculus of speeds, feeds, strengths and powers in manufacture 8. Procedures of measurement.
Laboratory practical	*P1-2 PLM. Design of product and of process. Platform CADCAM available (Catia, NX, Fusion) 2h +2h P3 Planning process of manufacturing. Design of Tooling for product 2h P4 -5 -6 Programming assisted of machined tooling, CAM, (Catia, NX, Fusion, □) 6h P7 -8 -9 Supervsing works 6*h
Mentored work	Project (Work to make by student. It would correspond to Groups C of 5 students) Total 18*h
Lecturing	Synthetic teaching of the topics Proposition real cases and problems

Personalized assistance

Methodologies	Description
Mentored work	Attending Works and supervising projects (groups from among 3 and 5 people).

Assessment

	Description	Qualification	Evaluated Competencess		
Objective questions exam	Examination with questions type test, in which the no hit answers discount. The test can comport questions of type problems and development.	50	CG3	CE20	CT2 CT8 CT9
Essay	Development of project of course. It will evaluate , the capacity of work in team, creativity, autonomous work and in case of public presentation the capacity of communication and *sintesis.	50		CE20	CT2 CT9 CT10 CT17 CT20
Essay questions exam	Development of problems and or cases	50		CE20	CT2 CT8 CT9 CT10

Other comments on the Evaluation

The evaluation consists of:

A.-) Examination of theorical questions : It´s mandatory that students have a mark > 4 (0 to 10) to be able to make averarage with part B (Project or Examination of questions of development) Value 50%

Practical Part, The student has to choose between *B1 or *B2
B1.-)Project. Value 50%
B2.-)Examination of development questions : Consistent in problems and cases. Value 50%

The final mark is the average mark A +B, being B= B1 or B2

ethical Commitment: it expects that the present student a suitable ethical behaviour. In the case to detect a no ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices, and others) will consider that the student does not gather the necessary requirements to surpass the matter. In this case the global qualification in the present academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

Complementary Bibliography

Pereira A., Prado T., **Notes of the subject IF**, 2015,
Pereira A., **Exercises and cases of manufacturing Engineering**, 2016,
Kalpakjian, S., **Manufacturing Engineering and Technology**, 7th ed.,

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of manufacturing systems and technologies/V12G360V01402

Other comments

Requirements:
To enrol in this matter is necessary to have surpassed or be enrolled of all the matters of the inferior courses to the course in which it is situated this matter.

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes extraordinary planning that will be activated at the time that the administrations and the institution itself determine it based on safety, health and responsibility criteria. , and guaranteeing teaching in a non-classroom or partially classroom setting. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way by being known in advance (or well in advance) by students and teachers through the standardized tool and institutionalized teaching guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies that are maintained
All. With the exception of the realization that will be carried out remotely
* Non-face-to-face service mechanism for students (tutorials)
Through virtual dispatch on remote campus
* Additional bibliography to facilitate self-learning
Documents or links to necessary educational resources will be published in faitic
=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out
They are all kept with the same weight and value

* Pending tests that are maintained
They will be carried out electronically through faitic keeping the same weight and value

IDENTIFYING DATA				
Electrical machines				
Subject	Electrical machines			
Code	V12G360V01605			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Prieto Alonso, Manuel Angel			
Lecturers	Prieto Alonso, Manuel Angel			
E-mail	maprieto@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	O obxectivo desta materia é dotar ao alumno dunha formación básica, tanto teórica como práctica, sobre as máquinas eléctricas rotativas, en canto á constitución, modos de funcionamento e aplicacións.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE10	CE10 Knowledge and use of the principles of circuit theory and electrical machines.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT14	CT14 Creativity.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.
CT19	CT19

Learning outcomes			
Learning outcomes	Competences		
To understand the basic aspects of the construction and operation of the classical electric machines.	CG3	CE10	CT1 CT16
To master the experimental process used to characterise the different types of E.M.	CG3	CE10	CT1 CT2 CT6 CT16 CT17
To know the industrial use of the different types of E.M.	CG3		CT1 CT14 CT16 CT19
To understand the difference between 'classical' and 'modern' E.M.	CG3	CE10	

Contents	
Topic	
UNIT I: INTRODUCTION TO THE ELECTRICAL MACHINES	I-1 Electromagnetic and electro-mechanic fundamental laws. General behaviour notes: Physical arrangement of the electrical machines. Types of machines. Losses. Energy balance. Efficiency. Heating. Cooling. Rated power. Insulation types. Degrees of mechanical protection and construction types. Nameplate. I-2 Principles of Construction. Magnetic poles. Neutral line. Pole-pitch. I-3 M.M.F□s and E.M.F□s inside the machine: Fields generated with concentrated and distributed windings. Rotating magnetic field. Winding factor.

UNIT II: INDUCTION MOTORS (ASYNCHRONOUS)	II-1 Three-phase induction machine Construction characteristics. Operating principles. Electrical equivalent circuit. Powers and torques. Electrical tests. Energy balance and efficiency. T-s curve. Operation modes. Starting methods and speed control. II-2 Single-phase induction motor Construction characteristics. Operating principles. Electrical equivalent circuit. Starting methods. UNIT III: SYNCHRONOUS MACHINES (GENERATORS) Construction characteristics. Operating principles. Armature reaction. Salient poles and cylindrical rotor machines. Electrical equivalent circuit. Stand-alone and grid-connected behaviours. Synchronous motor: Characteristics and uses
UNIT III: SYNCHRONOUS MACHINES (GENERATORS)	Construction characteristics. Operating principles. Armature reaction. Salient poles and cylindrical rotor machines. Electrical equivalent circuit. Stand-alone and grid-connected behaviours. Synchronous motor: Characteristics and uses.
UNIT IV: D.C. MOTORS. SPECIAL MACHINES	IV-1 Construction characteristics. Operating principles. Excitation systems. Armature reaction. Commutation. Armature reaction. Speed control. IV-2 Special machines: Step Motors, PMDC, Reluctance Motors
UNIT V: PROTECTION AND CONTROL OF ELECTRICAL MOTORS	Low voltage switch gear. Electrical machines protection systems.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	65	97.5
Laboratory practical	10	16	26
Problem solving	8	16	24
Objective questions exam	1	0	1
Problem and/or exercise solving	1.5	0	1.5

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

Methodologies

	Description
Lecturing	(*)Exposición por parte do profesor dos contidos sobre a materia de máquinas eléctricas.
Laboratory practical	(*)Actividades de aplicación dos coñecementos teóricos a situacións concretas e de adquisición de habilidades básicas e procedimentales relacionadas coas máquinas eléctricas rotativas. Desenvolverase no laboratorio de máquinas eléctricas correspondente.
Problem solving	(*)Actividade na que se formulan problemas e exercicios relacionados coa materia de máquinas eléctricas rotativas. O profesor resolverá problemas tipo de máquinas rotativas e o alumno debe resolver problemas similares.

Personalized assistance

Methodologies	Description
Lecturing	Any question can be arised during the lessons. Office hours are also available for the students.
Laboratory practical	During the realization of the practical tests any possible question will be solved.
Problem solving	All numerical exercices will be solved in this classes. Q and A will be highly recommended.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	The evaluation of the practical laboratory tests will be done in a continuous way (session to session). The evaluation criteria is : - Minimum attendance of 80%. - Punctuality . - Previous preparation of the practical test. - Correct utilization of the material . Practical tests results, if required . Not attending the lab lessons will imply 0 point in this part. Attendance below 80% will imply 0 point in this part. To pass the whole subject, a mark higher than 40% in this part in mandatory.	10	CG3	CE10	CT1 CT2 CT14 CT16 CT17 CT19

Problem solving	The evaluation of the exercises will be done in a continuous way (session to session). The evaluation criteria is : - Minimum attendance of 80%. - Punctuality . - Previous preparation of the exercise, if required. . Correct exercise result, if required. .	5	CG3	CE10	CT1 CT2 CT6 CT16
Objective questions exam	The assessment method will be a multiple choice test, to be done individually without the use of any information source. There will be one unique test for the whole subject, and it will cover not only the theoretical lessons but the practical lab tests. A minimum mark of 40% will be required in this part.	55	CG3	CE10	CT1 CT6
Problem and/or exercise solving	The assessment method will be a numerical resolution of an exercise of electrical machines A minimum mark of 40% will be required in this part.	30		CE10	CT1 CT2 CT14 CT16

Other comments on the Evaluation

Second attempt (July)

If a student does not reach an 80% for the lab lessons or his/her marks are not higher the minimum required, a practical exam will be necessary to pass this part.

To pass the subject a minimum of 5/10 will be required (result of the sum of the 4 subject parts)

Commitment: An student ethical behaviour is expected. If not ethical behaviour is detected (copying, cheating in any way, using unlicensed electronic devices, and others), it will considered that the student does not gather the necessary requirements to pass the subject.

In this case the global qualification in the present academic course will be (0.0). (FAILED)

Sources of information

Basic Bibliography

Jesús Fraile Mora, **Máquinas Eléctricas**, McGraw-Hill/Interameericana de España S.A.U,

Jesús Fraile Mora y Jesús Fraile Ardanuy, **Problemas de Máquinas Eléctricas**, McGraw-Hill/Interameericana de España,

Stephen J. Chapman, **Máquinas Eléctricas**, McGraw-Hill,

Manuel Cortés Cherta, **Curso Moderno de Máquinas Eléctricas Rotativas (I,II,III)**, Editores Técnicos Asociados,

Complementary Bibliography

Javier Sanz Feito, **Máquinas Eléctricas**, Prentice Hall, 2002

Sanjurjo Navarro, **Máquinas Eléctricas**, García-Maroto, 2011

Suárez Creo, Juan M, **Máquinas eléctricas : funcionamiento en régimen permanente**, Tórculo, 2006

Fitzgerald, Arthur Eugene, **Máquinas Eléctricas**, McGraw-Hill, 2004

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Basics of circuit analysis and electrical machines/V12G360V01302
Applied electrotechnics/V12G360V01501
Physics 3/V12G360V01503

Other comments

Requirements: To enrol in this subject is necessary to surpass or well be enrolled of all the subjects of the inferior courses to the course in the that is situated this subject.

In case of discrepancies, will prevail the version in Castilian of this guide.

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 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 no totally face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a way but agile and effective 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 **DOCNET.

ADAPTATION OF THE METHODOLOGIES

1- educational Methodologies that keep
- Lesson *magistral
- Resolution of problems
2- educational Methodologies that modify
- Practical of laboratory: they would substitute by explanatory videos and the utilisation of programs of simulation
3- Mechanism no face-to-face of attention to the students (*tutorías)
- The sessions of *tutorías can make by telematic means: email, forums of *FAITIC, ...Etc or videoconference under the modality of *concertación previous.

ADAPTATION OF The EVALUATION

The proofs of evaluation would be supported by the even format and with the same weights, making these with the telematic means provided by the University of Vigo

IDENTIFYING DATA				
Chemical technology				
Subject	Chemical technology			
Code	V12G360V01606			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Sanroman Braga, María Ángeles			
Lecturers	Longo González, María Asunción Rosales Villanueva, Emilio Sanroman Braga, María Ángeles			
E-mail	sanroman@uvigo.es			
Web				
General description	In this subject, students learn the basic aspects of Chemical Engineering and the fundamentals of the basic operations most employed in industry. 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	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
To know the bases of chemical technology.	CG3	CE4	CT9
To apply mass and energy balances to real systems.	CG4	CE4	CT2 CT9 CT10 CT17
To know and understand the basic aspects of mass transfer.	CG3	CE4	CT9
To know the fundamentals of separation processes and their application to real cases.	CG4	CE4	CT2 CT9 CT10 CT17

Contents	
Topic	
Introduction	Chemical Engineering. Basic principles. Chemical processes. Unit conversion and calculation tools
Mass and energy balances	Mass balances for systems without chemical reaction. Mass balances for systems with chemical reaction. Energy balances
Implementation of balances into chemical reactor design	Stoichiometry. Reaction rate. Ideal reactors
Mass transfer	Introduction. Mass transfer equations: individual and global coefficients
Distillation and rectification of liquid mixtures	Vapour□liquid equilibrium. Simple distillation. Rectification. Azeotropic and extractive distillation.

Liquid-liquid extraction	Fundamentals. Binary and ternary mixtures. Factors that affect the separation. Operation by simple contact, multiple contact in direct current, multiple contact in multiple countercurrent
Other operations in chemical processes	Gas absorption. Liquid-solid extraction. Adsorption and ion exchange.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Problem solving	17	31	48
Laboratory practical	8	8	16
Problem and/or exercise solving	2	8	10
Report of practices, practicum and external practices	0	2	2
Essay questions exam	3.5	10.5	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	Direct oral exposition of the most important contents of the subject by the lecturer.
Problem solving	The lecturer suggests various problems to the students so they can work on them at home. Then, the lecturer solves them in the seminar classes.
Laboratory practical	The students will perform some experiments in the laboratory, solving problems in seminar classes and field practices in companies related to the topics covered throughout the course. In addition, the students will evaluate different processes using simulation software. The aim of the laboratory practices is to deepen basic concepts.

Personalized assistance

Methodologies	Description
Lecturing	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Problem solving	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Laboratory practical	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.

Assessment

	Description	Qualification	Evaluated Competencess		
Problem and/or exercise solving	The students will carry out various tests with problems and short-answer questions. The average mark will represent 30% of the final mark.	30	CG3 CG4	CE4	CT2 CT9
Report of practices, practicum and external practices	Apart from the mark of the practice report, the lecturer will take into account the attendance as well as the attitude that the students have on the practices.	10		CE4	CT9 CT10 CT17
Essay questions exam	Theoretical-practical exam of the basic concepts and procedures related to the subject matter, in the date fixed by the Centre.	60	CG3 CG4	CE4	CT2 CT9

Other comments on the Evaluation

The participation of the student in any of the evaluation systems of the subject will imply that the student effectively take the subject and its qualification.

To pass the subject, it is necessary that the student obtains a minimum of 5 points out of 10 in each of the proposed evaluation systems. In the case of students who do not attain the minimum in all evaluation systems, they will fail to achieve the pass mark, with a numerical value obtained by following the percentages of the evaluation systems described above, or equal to that obtained in the non passed part.

In July, the previous marks of the evaluation systems will be are kept if a minimum of 5 points out of 10 is achieved; therefore, the students will just have to take an essay or questions exam (theoretical-practical exam).

For students who are allowed by the School to skip the continuous assessment procedure: The qualification of these students will be formed by the mark of the essay & questions exam (90%) and the mark of the practices (10%).

Ethical commitment: The student is expected to present adequate ethical behaviour. In the event that unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, etc.), it will be considered that the student does not meet the necessary requirements to pass the subject. In that case, the overall rating in the current academic year will be fail (0.0). The use of any electronic device for the assessment exams is not allowed unless explicitly authorised. The fact of introducing unauthorised electronic devices in the examination room will be considered as a reason for not to pass the subject in the current academic year and will hold overall rating (0.0)

Sources of information

Basic Bibliography

Himmelblau, D.M., **Basic principles and calculations in chemical engineering**, 6th,

Felder, R.M. y Rousseau, R.W., **Elementary principles of chemical processes**, 3rd,

Ocón, J. y Tojo, G., **Problemas de Ingeniería Química**, 3rd,

Coulson, J.M. and others, **Chemical Engineering vol. 1 and vol 2**, 5th,

Treybal, R.E., **Mass-transfer operations**, 3rd,

Calleja, G, **Introducción a la ingeniería química**, 1ª,

Levenspiel, O., **Chemical Reaction Engineering**, 3rd,

Wankat, P.C., **Ingeniería de procesos de separación**, 2ª,

McCabe, W.L., Smith, J.C. y Harriott, P., **Unit operations of chemical engineering**, 7th,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Calculus 1/V12G360V01104
Mathematics: Calculus 2 and differential equations/V12G360V01204
Chemistry: Chemistry/V12G360V01205

Other comments

Requirements: To enrol in this subject, it is necessary to have passed or be enrolled in every subject of inferior courses. In case of discrepancies, it will prevail the Spanish version of this document.

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 be activated in the moment that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in blended or distance learning mode. 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 by the students and the teaching staff through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep
Lesson magistral: they will develop by means of synchronous virtual sessions that they will be able to be complemented with videos or other didactic materials.
Resolution of problems: it will be proposed to the students series of problems so that they work on them and that will be reviewed in synchronous virtual sessions.
Practices of Laboratory: it will make only by means of the evaluation of industrial chemical processes by means of the handle of a Chemical processes simulation software.
Educational Methodologies that modify
None adapt all the methodologies to the non face-to-face modality
* Mechanism non face-to-face of attention to the students tutoring.
differentiate two types of mechanisms non face-to-face of attention to the students: generals and individual.
Generals: The lecturers in the schedule established by the centre will connect in a virtual classroom to which will assist all the students and in which the lecturers will orient on the material supplied to the students or will expand concepts according to the established in the educational guide.
Individual: The lecturers will attend in their schedule of tutoring to the students in the virtual room.

* Modifications (if they proceed) of the contents to give
there are not modifications
* additional Bibliography to facilitate the self-learning
is not necessary
* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Pending proofs that keep
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Proofs that modify
[previous Proof] => [new Proof]

* New test

* additional Information
Vulnerable students: It will be made a methodological adaptation, facilitating them additional specific information when it is proved that they cannot have access to the contents provided by the conventional ways.

Evaluation: The systems of evaluation will be developed face to face except Resolution of the university board that indicate that they have to do innon face to face mode, making of this way through the different tools put to disposal of the teaching staff.

IDENTIFYING DATA				
Electronic instrumentation				
Subject	Electronic instrumentation			
Code	V12G360V01701			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo Marcos Acevedo, Jorge Rodríguez Castro, Francisco			
E-mail	eguizaba@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	A Instrumentación Electrónica é a parte da electrónica que se ocupa da medición de calquera tipo de magnitude física, da conversión da mesma a magnitudes eléctricas e do seu tratamento para proporcionar a información adecuada a un sistema de control, a un operador humano ou ambos. A instrumentación ten dous grandes temas de traballo: - O estudo dos sensores e dos seus circuítos de acondicionamento. - O estudo dos equipos de Instrumentación, que se empregan na industria para a medida de calquera tipo de variable física.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE23	CE23 Applied knowledge of electronic instrumentation
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
(*)	CG3	CE23	
(*)		CE23	CT9
New			CT2 CT9
New		CE23	CT2
New			CT17

Contents	
Topic	
Topic 1: Introduction to the electronic instrumentation	The electronic instrumentation in the context of the control of processes. Systems of measure and his characterisation.
Topic 2: Systems of Acquisition of Data (DAS or DAQ). Auxiliary circuits	Bridges of measure. Fixers of tension. Sources of current. Converters V/I and I/V.
Topic 3: DAS. Amplification and signals filtering	Amplifiers of instrumentation, programmable amplifiers, amplifier of isolation. Types of filters. Technicians of implementation of active filters.
Topic 4: DAS. Circuits of conversion and multiplexed	Circuits of show and retention (S&H). Conversion A/D and D/A, types and technical characteristics. Analog switches. Multiplexer analog.
Topic 5: Implementation of systems of acquisition of data	Basic structures. Criteria of election in function of the parameters of the system.
Topic 6: Physical principles of sensors	Introduction. Piezoelectricity. Magnetostriction. Piezoresistivity. Pyroelectricity. Magnetoresistance. Thermoelectricity. Thermoresistivity. Photoresistivity. Inductive sensors. Capacitive sensors. Ultrasonic sensors.
Topic 7: general Characteristics of the sensors	Technical characteristics. Types of commercial exits. Connection of sensors to electronic systems of control.
Topic 8: Proximity sensors	Inductive, capacitive, ultrasonic, optoelectronic, magnetic and safety sensors.

Topic 9: Sensors of temperature and of discharge	Sensors of Temperature: Thermocouples, sensors of infrared and integrated sensors. Sensors of discharge: Sensors of differential pressure, vortex, acceleration of *Coriolis, of turbine, electromagnetic. Criteria of selection.
Topic 10: Pressure and level sensors	Pressure sensors (Primary measuring elements: Bourdon tube, diaphragm, bellows), potentiometric, piezoelectric, capacitive, inductive, strain gauge and magnetostrictive. Level sensors: Ultrasonic, resistive, float, static pressure, differential pressure, conductivity, capacitive, inductive, optical, rotary vane and radioactive. Selection criteria.
Topic 11: Displacement sensors	Inductive sensors: LVDT, RVDT, Synchrogenerator and Resolver. Optoelectronic sensors: Absolute and incremental encoders. Applications. Selection criteria.
Topic 12: Sensors of electrical and magnetic variables	Transformer of intensity. *Shunt. Sensors of effect *Hall. Measure of magnetic fields with *Magnetorresistencias. Criteria of selection.
Topic 13: Introduction to the control of processes based in the use of microcontrollers	Introduction to the control of processes Introduction to the microcontrollers Introduction to the actuators: hydraulic, tyres and electronic (Electronics of Power)
Topic 14: Teams of electronic instrumentation	Classification, technical characteristics and connection of teams of instrumentation. Criteria of selection. Buses of instrumentation.
Topic 15: Introduction to Power Electronics (PE)	Introduction. Structure of the systems of PE. Types of converters. Semiconductors of powers. Passive components in PE. Calculation of powers.
Practice 1. Circuits with operational amplifiers.	Study of basic settings with operational amplifiers, linear settings and no linear.
Practice 2. Introduction to the Virtual instrumentation. LabVIEW.	The execution data flow on LabVIEW. Frontal panel and diagrams of blocks. Description of the main types of data and structures of programming.
Practice 3: LabVIEW Application with teams of commercial electronic instrumentation: Cards of Acquisition of Data (DAQ) and datalogger.	Description of the NI 6008 DAQ and of the datalogger DT80. Example of application based in LabVIEW.
Practice 4: System of acquisition of data for the measure of temperature.	It will be implementing a system of acquisition of complete data for the conditioning of a sensor of temperature PT1000.
Mentored work.	- Implementation of a circuit of conditioning for the measure of a physical variable and his back acquisition by means of TAD. - Implementation of a system of control of a physical variable, based on a microcontroller. - Data adquisition software. Relational Database. ERP

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	30	58
Laboratory practical	12	6	18
Problem solving	8	13	21
Mentored work	6	30	36
Essay questions exam	3	10	13
Objective questions exam	1	3	4
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Lecturing	They will develop in the schedules fixed by the direction of the centre. They consist in an exhibition, by part of the professor, of the contents of the matter. Also it will proceed to show examples and technical solutions that illustrate properly the problematic to treat. The student will be able to expose all the doubts and questions that consider timely, during the session. The teacher will look for the most active possible of the student.
Laboratory practical	It will show to the student some practical settings or simulations on the matter treated that they put of self-evident the technical characteristics of the settings made, as well as the form to make measures in the same by means of sensors and the instrumentation of the laboratory.
Problem solving	The complementary activity of the magistrate's sessions in which they formulate problems and/or exercises related to the subject. The student will have to develop suitable solutions to the problems and/or exercises proposed in the classroom and of other extracted of the bibliography. They will identify possible doubts that will resolve in the classroom or in personalized tutorials.

Mentored work	This time devotes to the realisation of works of laboratory in team, related with the conditioning of sensors, visualisation of the variable measured and storage of information.

Personalized assistance

Methodologies	Description
Laboratory practical	The teacher will personally attend to the doubts and queries of the students, about the study of theoretical concepts, laboratory practices or projects. Students will have the opportunity to attend personalized tutorials or in groups in the teacher's office at the time established for that purpose at the beginning of the course and which will be published on the subject page.
Mentored work	In the practical classes and in tutorials each of the doubts that arise in the completion of the work will be solved in a personalized way.

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	The students will make the designs and planned settings in the billed of the practice and will deliver a memory with the results of the same.	10	CT9 CT17
Mentored work	Once made the supervised work, the students will owe to elaborate a descriptive memory. It will fix a day for the delivery of the memory and the presentation of the work made, to the professor. This note will form part of the continuous evaluation.	25	CT9 CT17
Essay questions exam	In the dates indicated by the calendar of examinations of the centre, will make the final proofs that will consist in problems of development.	30	CT2
Objective questions exam	In the dates indicated by centre and by means of continuous evaluation, will make proofs of short questions of test.	35	CG3 CE23

Other comments on the Evaluation

Long answer tests and multiple choice tests will be carried out on the dates set by the center and will represent 65% of the final grade. The remaining 35% will correspond to the grade obtained throughout the course, through continuous evaluation, of the laboratory practices and the supervised work. In each of these evaluations a minimum grade of 30% will be required

Students who are recognized by the management of the center for their resignation from continuous assessment, must attend the final test. This will represent 65% of the grade, the remaining 35% will be obtained through a practical exam and the completion of a work. In this case, the practical exam and the work will be compulsory, and in these tests a minimum grade of 50% must be obtained.

In the second call, the same procedure will be followed.

The practice note will only be saved for one academic year.

Ethical commitment:

The student is expected to exhibit appropriate ethical behavior. In the case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, and others) it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade in the current academic year will be a failure (0.0).

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

THE ACQUISITION OF SKILLS AND ITS INFLUENCE ON THE EVALUATION

In this subject there is no competency assessment approach. Next, it is specified how the different teaching activities exercise the student in the different competencies and how their acquisition conditions the final grade obtained by the student.

CG3. Knowledge of basic and technological subjects, which enables them to learn new methods and theories and gives them the versatility to adapt to new situations.

The acquisition of this competence is guaranteed (in the scope of the subject) by its own contents. The self-assessment activities, the practicals and the different assessment tests deal with these content of a technological nature.

CT2. Problem resolution.

Students exercise in this competence through the proposed activities: problem sets and theoretical resolution of the assemblies proposed in the practice statements. The acquisition of competence in the field of the subject is justified by the fact that the assessment tests (thematic blocks and individual tests) consist almost entirely of problem solving.

This competence is achieved and evaluated in the proposed laboratory work. These are carried out in groups of two and at the end of them, each group must submit a written report of the activities carried out. The students who prepare the best works must make an oral presentation.

CT9. Apply knowledge.

The students exercise this competence, especially in the laboratory sessions, where they have to transfer to the simulations and to the assembly and real measurements what was studied in the theoretical sessions. The laboratory sessions are evaluated one by one, averaging the final grade as long as there is minimal attendance and use.

CT17 Teamwork.

The students exercise this competence in the laboratory sessions, since these sessions are carried out in teams of two. Collaboration between both students is necessary to successfully carry out the setups, measurements and data collection required in each experiment. The practice teacher verifies that the prior preparation and development of each of the sessions is the result of the collaboration of the two members of each group. In case of detecting anomalies in this sense, the qualifications of each member of the group are penalized and individualized.

Sources of information

Basic Bibliography

M. A. Pérez García, J. C. Álvarez Antón, J. C. Campo Rodríguez, F. J. Ferrero Martín y G. J. Grillo, **Instrumentación Electrónica**, Thomson, 2003

Franco, Sergio, **Diseño con amplificadores operacionales y circuitos integrados analógicos**, 3ª edición, Mc Graw-Hill, 2013

Del Río Fdez, J., **LabVIEW: Programación de sistema de instrumentación**, 1ª, Garceta, 2011

Pérez García, M., **Instrumentación Electrónica: 230 problemas resueltos.**, 1ª, Garceta, 2012

Complementary Bibliography

Enrique Mandado Pérez, Jorge Marcos Acevedo, Celso Fernández Silva y José I. Armesto Quiroga, **Autómatas programables y sistemas de automatización**, Marcombo, 2009

Faludi, Robert, **Building wireless sensor networks**, O' Reilly, 2011

Recommendations

Subjects that continue the syllabus

Control and industrial automation/V12G360V01801

Subjects that it is recommended to have taken before

Automation and control fundamentals/V12G360V01304
Basics of circuit analysis and electrical machines/V12G360V01302
Electronic technology/V12G360V01401

Contingency plan

Description

=== ADAPTATION OF METHODOLOGIES ===
* Teaching methodologies that are maintained
All except laboratory practices are maintained. The other methodologies will be carried out remotely.

* Teaching methodologies that are modified
In the case in which the teaching is exclusively non-face-to-face, the laboratory practices could be carried out virtually. Multisim and LabView software would be used.
In the same way, the supervised work will be carried out in a non-presential way, for which the work will be adapted to this situation.

* Non-face-to-face mechanism of attention to students (tutorials)
The attention of the students would be carried out remotely by videoconference, email and telephone.

* Modifications (if applicable) of the content to be taught

There are no changes

* Additional bibliography to facilitate self-study
There are no changes. The bibliography included in point 8 will continue to be used, in addition to the additional documentation that is in FAITIC, although it is likely that some additional article will be included.

* Other modifications
No more modifications

=== ADAPTATION OF THE EVALUATION ===
The evaluation will continue without changes, with the difference that the exams would be done in a non-face-to-face way.

IDENTIFYING DATA				
Technical Office				
Subject	Technical Office			
Code	V12G360V01702			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Alonso Rodríguez, José Antonio Cerqueiro Pequeño, Jorge			
Lecturers	Alonso Rodríguez, José Antonio González Cespón, José Luis			
E-mail	jcerquei@uvigo.es jaalonso@uvigo.es			
Web	http://webs.uvigo.es/oficinatecnica			
General description	This matter has like vision and like mission approach to the student to his back professional life through the knowledge, handle and application of methodologies, technical and tools oriented to the preparation, organisation and management of projects and other technical documents. It employed a practical approach of the subjects, looking for the integration of the knowledges purchased to the long of the career of face to his application to the development of the methodology, organisation and management of technical works, as true essence of the profession of engineer in the frame of his *atribucións and fields of activity. *Promoverase The development of the competitions of the matter by means of a theoretical approximation-practical, in which the exposed contents of theoretical way develop by means of the realisation of practical activities and works of application oriented to the industrial reality of the profession, assimilating the agile and precise employment of the distinct rule of application and of the best practices established. Given the variety that produces in the spectrum of professional exits, the academic program possesses a part of general contents to all the Industrial Engineers, in which it treats to transmit those appearances that reinforce the **pluridisciplinaridad and possesses another more specific part of the speciality, that does reference to methodological or normative appearances of this field. Likewise the strategy employed allows to expose to the student the professional alternatives that open him , from the free professional exercise (**peritaciones, *ditames, reports, projects, etc.), even his immersion in a small / average technical office more oriented the installations or even to the design of product.			

Competencies	
Code	
CG1	CG1 Ability to design, develop, implement, manage and improve products and processes in various industrial fields, through analytical, computational and experimental appropriate techniques.
CG2	CG2 Ability to lead activities related to CG1 competence.
CE18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT7	CT7 Ability to organize and plan.
CT8	CT8 Decision making.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
CT13	CT13 Ability to communicate orally and in writing in the Galician language.
CT14	CT14 Creativity.
CT15	CT15 Objectification, identification and organization.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes

Learning outcomes		Competences	
(*)		CE18	CT3 CT5 CT6 CT9 CT10 CT17
(*)	CG1 CG2	CE18	CT1 CT2 CT5 CT6 CT7 CT8 CT10 CT11 CT15 CT17 CT20
(*)	CG1 CG2		CT1 CT3 CT5 CT6 CT7 CT9 CT14 CT15 CT17
(*)	CG2	CE18	CT1 CT2 CT3 CT5 CT6 CT7 CT8 CT9 CT11 CT13 CT14 CT16 CT17 CT20
(*)			CT3 CT5 CT6 CT7 CT13 CT14 CT17 CT20

Contents	
Topic	
Presentation	Presentation Guides Educational Methodology of work. Groups of work *Fontes of information and communication: SUBJECT and other Knowledges and *aplicacions computer for the matter.
Technical office.	Introduction *Funcions. Organisation of the work. Technicians of Work in instruments. Integration with the systems of the company. *Kanban. Taking of decision by means of weighting of criteria. Communication.

Cycle of life of a project	Phase I. Start. Diagram of functional blocks and the *sua description. Global definition of the project. Legal feasibility. (*PGOM And environmental legislation) Phase II. Scope and aims. Phase III. Realisation of the project. Phase IV. Closing: permissions and certifications of the project
Industrial project.	Project: Concept, classification, structure, cycle of life. Documents of the project: Index, memory, planes. *pliegos Of conditions, budget, studies with own entity. Normalisation. It JOINS 157002.
Administrative management of works of engineering.	Processing: visa, notary, Public Organisms, etc. Management of licences, permissions and permissions in front of public and personal institutions. Bidding and contracting of projects.
Industrial project. Planes	Structure and index of the planes. Typology of representation: dimension and relation. Block of titles. Sizes and scales. Folded. Criteria for wool preparation of planes. Example; planes of distribution. Example: planes of installations. Diagrams of principle. Legend of symbology.
Fire protection	Basic concepts: classification, sectorization, classification of materials, NRI, evacuation, means of protection. RD 2267/2004 and CTE DB-SI.
Budget and planning.	Measurement economic assessment Theory of management and planning of projects. Agile methodologies, *Gantt, *CPM and *PERT
Basic elements of construction	Basic elements of construction. Cover. *Cimentación. Structural elements. Coatings. Carpentries. Finishings. Examples.
Methodology of design of installations	Types of installations. Determination of loads. Elements of feeding of the loads. Elements of performance control and security. Planes of installations and diagrams of principle.
I fold of Conditions.	Types. Administrative Technical *Facultativas Bidding and contracting of projects.
Legislation.	Legislative legislation Interpretation of the technical legislation generic technical Legislation applied the speciality: *RD 485/1997, *RD 486/1997, *PGOM, *RD 314/2006
Technical documents.	Report: Concept, classification, structure. Certifications . Homologation *Peritaciones, Valuations.
Studies with own entity.	Relative studies to the fulfillment of the legislation of labour risks: Basic Study of Security and Health. Relative studies to the fulfillment of the legislation of management of waste.
Professional activity.	Processing: visa, notary, Public Organisms, etc. Management of licences, permissions and permissions in front of public and personal institutions. Bidding and contracting of projects.
Patent rights.	Technological innovation and patent rights. Patents and models of utility.
(*)Comunicación	(*)Técnicas de presentación de trabajos orales y escritas

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Lecturing	12	24	36
Mentored work	2	6	8
Project based learning	12	24	36
Problem solving	6	6	12
Practices through ICT	4	4	8
Design Thinking	2	8	10
Learning-Service	4	20	24
Scientific events	2	8	10
Presentation	1	3	4

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

Methodologies	
	Description
Introductory activities	The subject will be presented, information on the contents of the same, methodologies to be applied, work to be done in the subject and form of evaluation. Likewise, dynamics will be carried out in the class to promote the interrelationship in the students.
Lecturing	Presentation by the teacher of the contents on the subject of study, theoretical bases and/or guidelines of a work, exercise or project to be developed by the student.
Mentored work	Prepare a technical report on any issue related to Industrial Engineering, with the quality and rigour expected of an Industrial Engineer.
Project based learning	Work will be done using the methodology of "Project-Based Learning- *ABP". Realization of an engineering project, working with an open team. Emphasis will be placed on applying industrial engineering tools and knowledge to create engineering solutions for the real needs of an industry. Submit Problem solving The student must develop the right or correct solutions the exercises posed that are based on the theory taught. They will be performed by applying formulas, algorithms or transformation procedures gives available information. Interpretation of the results will be necessary.
Problem solving	The student must develop the right or correct solutions the exercises raised that are based on the theory taught. They will be performed by applying formulas, algorithms or transformation procedures gives available information. Interpretation of the results will be necessary.
Practices through ICT	Knowledge application activities in a given context, and the acquisition of basic and procedural skills in relation to the subject, through ICT.
Design Thinking	An interdisciplinary group will be created with students from other subjects and grades. This group, applying the methodology "Design Thinking" will generate a work of implementation and / or improvement on a specific activity.
Learning-Service	Learning-Service (ApS) is an innovative methodology that tries to change reality and improve students' learning. It is inserted into the set of activities carried out by a student, and connects with innovative proposals such as competency-based education, project-based or problem-based learning, cooperative and collaborative learning.
Scientific events	To present the ideas developed by students in collaborative groups, a presentation is organized in congress format. This will be public and broadcast in different media.

Personalized assistance	
Methodologies	**Description**
Project based learning	The student will complete an engineering project, working with an open team. Emphasis will be placed on the application of industrial engineering tools and knowledge to create engineering solutions for the real needs of an industry. Group tutorials will be held with the teacher to answer questions and to follow up on the work.
Mentored work	The student, individually, prepares a technical report, or similar document, on a topic proposed by the teacher. Tutorials will be individual. The student's doubts will be clarified and he/she will be helped in the organization and planning of the work. Tutorials can be done in small groups, bringing together students with the same problem, for a better efficiency.
Design Thinking	The students, in a multidisciplinary group with students from other degrees, will work on a solution to the problem posed. This will be done by applying the Design Thinking methodology and simultaneously applying the Learning as a Service methodology. Meetings are planned to explain the methodologies to be applied and group tutorials to monitor the work.
Scientific events	We will work with the different groups of students to help them prepare the public exhibition of their work. You will conduct several rehearsals with them and guide them to achieve an effective presentation
Learning-Service	This methodology is integrated with the Design Thinling, so the monitoring will be as indicated in that section.

Assessment				
	Description	Qualification	Evaluated Competencess	
Lecturing	Theory: The tests will be of a test type or short answer. Minimum grade for this part: 4 out of 10 (in this part)	20	CG1 CG2	CT2 CT9

Mentored work	Prepare a technical report on any issue related to Industrial Engineering, with the quality and rigor expected of an Industrial Engineer. An evaluation rubric will be published in the TEMA platform of the subject.	10	CG1		CT1 CT3 CT5 CT6 CT7 CT8 CT9 CT10 CT15 CT16
Project based learning	Realization of an engineering project, working with an open team. Emphasis will be placed on applying industrial engineering tools and knowledge to create engineering solutions for the real needs of an industry. An evaluation rubric will be published on the subject's THEME platform. The evaluation includes an individual test on the work and will weigh the project note as set out in the evaluation heading.	40	CG1 CG2	CE18	CT2 CT3 CT5 CT7 CT8 CT9 CT10 CT14 CT17 CT20
Learning-Service	make an interdisciplinary group work, with students from other subjects and grades. This group, applying the methodology "design thinking" will do a work of implementation and / or improvement on a specific activity. An evaluation rubric will be published in the TEMA platform of the subject.	20			
Scientific events	Presentation of the ideas developed by the students in the collaborative groups. This activity will be public and broadcast in different media. An evaluation rubric will be published in the TEMA platform of the subject.	5			CT1 CT3 CT5 CT6 CT17 CT20
Presentation	Class group presentation of the work done with the Service-Learning methodology	5			

Other comments on the Evaluation

EVALUATION SYSTEM:

The default evaluation system is the continuous evaluation system. The student who wishes to take advantage of the non-continuous evaluation system must officially request it, within the time and manner established by the E.E.I. If the student does not request such resignation or does not obtain the favorable verdict of the waiver of continuous evaluation, it is understood that this is in the continuous evaluation system.
The student who intends to request the waiver of continuous evaluation should notify the professor as soon as possible. It is recommended to do it at the beginning of the course, or before beginning teaching.
The evaluation will be made based on the rubrics that are published in the TEMA platform of the subject.

CRITERIA FOR OVERCOMING THE MATTER THROUGH CONTINUOUS EVALUATION:

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In order to pass the subject through continuous assessment, two conditions must be fulfilled simultaneously:
a) obtain a minimum score of 4 out of 10 in each of the evaluable sections or parts indicated in the rubrics that are published.
b) obtain an average grade, weighted according to the percentages indicated above, minimum of 5 out of 10.
If a section is suspended, or the student wishes to improve the grade of a section, he / she will have a maximum of two (2) opportunities to do so. In this case, a correction coefficient will be applied to the qualification of the section. The grade will be multiplied by a correction factor. The deadline for such corrections will be established by the teacher.

CRITERIA FOR OVERCOMING THE MATTER THROUGH EVALUATION NOT CONTINUING:

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Students who choose to officially renounce continuous assessment, must perform a job supervised by the teacher, consisting of an industrial project or similar, and an evaluation test.
The tutoring of the aforementioned work will begin in the first month of the semester. It is the responsibility of the interested student to contact the teacher to report the situation and receive the appropriate documentation and information.
To obtain the qualification, the proportional average will be found (60% theory and 40% practices).
It is mandatory to obtain a minimum grade of 4 points out of 10 possible in each one of the parts.
To overcome the subject, the aforementioned average must be a minimum of 5 points out of 10 possible.

ETHICAL COMMITMENT:
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The student is expected to exhibit adequate ethical behavior. By taking the course, the student acquires a commitment to teamwork, collaboration and respect for classmates and teachers. In the case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices and others) it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade in the current academic year will be suspended (0.0).

Sources of information

Basic Bibliography

Profesor de la asignatura, **Apuntes de Oficina Técnica**, Plataforma de teledocencia,, 2017

Complementary Bibliography

Cos Castillo, Manuel de, **Teoría general del proyecto**, Síntesis, 1995

Cos Castillo, Manuel de, **Teoría general del proyecto II**, Síntesis, 1995

Paso a paso con Gantt Project, conectareducacion.educ.ar, 2016

GARCIA-HERAS PINO, ÁLVARO y JULIÁN RODRÍGUEZ FERNÁNDEZ, **Documentación técnica en instalaciones eléctricas**, 2ª, Ediciones Paraninfo S.A., 2017

Comité CTN 157, **PROYECTOS, UNE 157001:2014:Criterios generales para la elaboración formal de los documentos que constituyen un proyecto técnico**, AENOR. ASOCIACION ESPAÑOLA DE NORMALIZACION Y CERT, 2014

GONZÁLEZ, FRANCISCO JAVIER, **Manual para una eficiente dirección de proyectos y obras**, FC Editorial, 2014

ARENAS REINA, JOSE MANUEL, **RÁCTICAS Y PROBLEMAS DE OFICINA TÉCNICA**, LA FABRICA, 2011

MARTÍNEZ GABARRÓN, ANTONIO, **Análisis y desarrollo de proyectos en la ingeniería alimentaria**, ECU, 2011

MONTAÑO LA CRUZ, FERNANDO, **Autocad 2017**, Anaya Multimedia, 2016

MEYERS FRED E., STEPEHENS MATHEW P., **Diseño de instalaciones de manufactura y manejo de materiales, Diseño de instalaciones de manufactura y manejo de materiales**, Prentice Hall, 2006

Tompkins, James A. White John A. Bozer, Yavuz A. Tanchoco J. M. A., **Planeación de instalaciones**, Cengage Learning editores S.A., 2011

Recommendations

Subjects that continue the syllabus

Final Year Dissertation/V12G360V01991

Subjects that it is recommended to have taken before

Graphic expression: Fundamentals of engineering graphics/V12G360V01101
Computer science: Computing for engineering/V12G360V01203

Contingency plan

Description

=== EXCEPTIONAL MEASURES PLANNED ===
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 plan that will be activated at the time when the administration and the institution itself decide, taking into account criteria of safety, health and responsibility, and guaranteeing teaching in a non-presential or partially presential scenario. These planned measures will guarantee, at any given time, the development of teaching in a more agile and effective way by being known beforehand (or well in advance) by students and teachers through the standardized and institutionalized tool of the teaching guides.

=== ADAPTATION OF THE METHODOLOGY ===
* Teaching methodologies that are kept
All of you, stick to the prescribed methodoloxies.

* Teaching methodologies that are modified
Teaching methods are not modified

* Non-presential mechanism for attending to students (tutorials)
By appointment through two virtual offices

* Modifications (if applicable) to two courses to be taught
No changes are made to the contents

* Additional bibliography to facilitate or self-learning

Documentation provided by the teachers through the MooVi platform,

* Other modifications
If given the sanitary circumstances of the moment, or by order of the authorities, it is not possible to celebrate in a physical way the congress of presentation of works ApS - Design Thinking, it would be substituted by taxed presentations, according to the instructions that facilitate, in their moment, the teachers of the subject.

=== ADAPTATION OF THE ASSESSMENT ===
The tests are not modified, nor are the percentages of the scores or the dates of the tests.

=== ADDITIONAL INFORMATION===
According to the instructions received, establish three contingency levels:

a) PRESENTIAL LESSONS: All teaching is face-to-face and is carried out in the usual way.

b) SEMI-PRESENTIAL LESSONS: In this case, when the governmental or academic authorities indicate, part of the classes will be given telematically in order to maintain safety distances. Nesta situação se impartirán de modo telemático, a través do campus remoto da Universidade de Vigo, as clases correspondentes á teoría da asignatura, impartiendo de modo presencial as clases prácticas, sempre que sexa posible manter os medios de segurança estable.

c) NON-PRESENTIAL LESSONS: All teaching will be given by telematic means through the remote campus of the University of Vigo.

In all cases, class schedules, activity calendars, learning objectives and tests will be maintained. Only the presence of the Congress of Collaborative Works may vary, if it is not possible, according to the health circumstances of the moment, to hold congresses or meetings in person.

The teaching staff will consider all the scenarios and will provide the students with the necessary didactic material according to the circumstances at each moment.

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G360V01703			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella Cameselle Fernández, Claudio Escudero Curiel, Silvia Rosales Villanueva, Emilio			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Subject that belongs to the Block of Common Subjects of the Industrial Technologies. It is part of the curricula of all Degrees of Industrial Engineering. The main objective is to achieve a basic knowledge about the Treatment and management of solid wastes, wastewaters and pollutant emission to the atmosphere. It includes also the concepts of pollution prevention and sustainability. Subject of the "English Friendly" program. International students may request the teacher Claudio Cameselle Fernandez: a) Materials and bibliographic references for the follow-up of the subject in English. b) Attend tutorials in English. c) Tests and evaluations in English.			

Competencies	
Code	
CG7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
CE16	CE16 Basic knowledge and application of environmental technologies and sustainability.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT12	CT12 Research skills.
CT17	CT17 Working as a team.
CT19	CT19

Learning outcomes	Competences
Basic knowledge and application of environmental technologies and sustainability	CE16 CT2 CT3 CT10 CT19
Problem solving	CE16 CT2 CT3 CT10 CT19
Oral and writing communication	CE16 CT2 CT3 CT10
Knowledge application to practical and real cases	CE16 CT2 CT3 CT10 CT19

Analysis and synthesis	CE16	CT1 CT2 CT3 CT9 CT10 CT12 CT17 CT19
Ability to analyze and determine the social and environmental impact of the technical solutions to environmental problems	CG7	CT1 CT3 CT9 CT10 CT17 CT19

Contents	
Topic	
Lesson 1: Introduction to the environmental technology.	1. Material cycle economy. 2. Introduction to the best available techniques (BAT).
Lesson 2: Management of waste and effluents.	1. Urban waste management. 2. Industrial waste management. Industrial waste treatment facilities. 3. Regulations.
Lesson 3: Treatment of urban and industrial wastes.	1. Valorization. 2. Physico-chemical treatment. 3. Biological treatment. 4. Thermal treatment. 5. Landfilling. 6. Soil remediation technologies
Lesson 4: Treatment of industrial and municipal wastewaters.	1. Characteristics of municipal and industrial wastewaters. 2. Wastewater treatment plant. 3. Sludge treatment. 4. Water treatment and reuse 5. Regulations
Lesson 5: Atmospheric pollution.	1. Types and origin of atmospheric pollutants. 2. Dispersion of pollutants in the atmosphere. 3. Effects of the atmospheric pollution. 4. Treatment of polluting gas emissions. 5. Regulations
Lesson 6: Sustainability and environmental impact assessment	1. Sustainable development 2. Life cycle analysis and economy. 3. Ecological footprint and carbon footprint. 4. Introduction to the environmental impact assessment
Practice 1: Codification of wastes	
Practice 2: Preparation of immobilized activated charcoal for use as an adsorbent.	
Practice 3: Contaminants removal by adsorption with immobilized activated charcoal.	
Practice 4: Coagulation-flocculation: Establishment of optimal working conditions.	
Practice 5: Simulation of certain stages of a EDAR .	
Practice 6: Life Cycle Analysis of a product.	

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Problem solving	11	22	33
Laboratory practical	12	12	24
Objective questions exam	1	0	1
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	6	6
Case studies	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Teaching in the classroom of the key concepts and procedures for learning the syllabus contents.
Problem solving	Solving exercises with the teacher's help and independently.
Laboratory practical	Application of the knowledge acquired to the resolution of problems of environmental technology, using equipment and facilities available in the laboratory/computer room.

Personalized assistance	
Methodologies	**Description**
Laboratory practical	In tutorials, students can consult with their teacher any questions about laboratory practices or the report of practices to be done. The tutoring schedule of the teaching staff will be public and accessible to the students.
Lecturing	In tutorials, students can consult with their teacher any questions arising in the lectures and related to the contents seen in them The schedule of tutorials of teachers will be public and accessible to students.
Problem solving	In tutorials, students can consult their teacher any questions about the resolution of problems raised in the classroom. The tutoring schedule of the teaching staff will be public and accessible to the students.

Assessment				
	Description	Qualification	Evaluated Competencess	
Objective questions exam	"FINAL EXAM" consisting of theoretical questions related to the syllabus of the subject. CG7, CE16 and CT19 competences will be assessed in this exam, based on student responses to the questions. CT1, CT3 and CT10 competences are also evaluated, since the exam is written and requires students' analysis and synthesis skills.	30	CG7 CE16	CT1 CT3 CT10 CT19
Problem and/or exercise solving	"FINAL EXAM" consisting of problems related to the syllabus of the subject. CT2, CT9 and CT19 competences will be assessed in this exam, based on the resolution of various exercises of environmental technology, which require the use of applied knowledge related to the contents of the subject. CT1, CT3 and CT10 competences are also evaluated, since the exam is written and requires students' analysis and synthesis skills.	30		CT1 CT2 CT3 CT9 CT10 CT19
Report of practices, practicum and external practices	Detailed report for each practices that includes the results and their discussion. The competences: CG7, CE16, CT1, CT3, CT9 and CT10, are assessed based on the quality of the written report elaborated by each student on his/her own. The following points will be evaluated in the report: text style and correctness, structure and presentation, analysis and discussion of the results, and conclusions. Competences CT12 and CT17 will be assessed based on the laboratory work. Lab practices will be carried out in pairs, and it is expected the student develop research skills in the field of environmental technology. The written report must be done in pairs.	10	CG7 CE16	CT1 CT3 CT9 CT10 CT12 CT17

Case studies	All exercises, seminars, practical cases and theoretical / practical tests that are made and delivered to the teacher throughout the course, related to the concepts and contents of the syllabus. Throughout a four-month time several tests are performed. Competences CG7 and CE16 will be assessed considering the students answers to the theoretical questions. Competences CT2, CT10 and CT12 will be assessed considering the students answers to the exercises. Competenci CT3 will be assessed base on the two parts of the exam: theory and exercises; considering the precision and clarity of the answers.	30	CG7 CE16	CT2 CT3 CT10 CT12

Other comments on the Evaluation

Evaluation

A student who choose continuous assessment, to pass the course, must achieve a **MINIMUN SCORE** of **4.0 points** (out of 10) ***in each of the parts of the "FINAL EXAM"*** , ie, theory (Objective questions exam) and problems (Problem and/or exercise solving). If a student reaches the minimum grade in both parts of the "FINAL EXAM", to pass the subject must obtain a **FINAL GRADE** of **≥ 5.0**, that is, when the sum of grades of the "practice report", "Case study" and the "FINAL EXAM" (Exam of objective questions + Problem solving and/or exercises) is ≥ 5.0.

Students who "*officially renounces continuous assessment*", will make a "FINAL EXAM" (Objective questions exam + Problem and/or exercise solving) that will be worth 90% of the final grade, and a "EXAM OF PRACTICES" that will be worth 10% of the final grade. In any case, to pass the course, the student must achieve 50% of the maximum score in each of the constituent parts of the subject, ie, theory, problems and practices.

Second call:

In the second call the same criteria apply.

In relation to the July exam, grades of the "Case studies" and "Practices report" are maintained, and students only have to repeat the "FINAL EXAM", ie, "Objective questions exam" + "Problem and/or exercise solving".

If, at the 1st call, a student suspended one of the parts of the "FINAL EXAM" (theory or problems) and approves the other party with a grade ≥ 6, on the July exam, you only need to repeat the suspended part.

Ethical commitment:

The student is expected to present an adequate ethical behavior. If you detect unethical behavior (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case the final grade, in the current academic year, will FAIL (0.0 points).

The use of electronic devices during the assessment tests will be allowed. The fact of introducing into the examination room an unauthorized electronic device, will be reason not pass the course in the current academic year, and the final grade will FAIL (0.0 points)

Sources of information

Basic Bibliography

Mihelcic, J.R. and Zimmerman, J. B., **Environmental Engineering: Fundamentals, sustainability, design**, Wiley, 2014

Davis, M.L. and Masten S.J., **Principles of Environmental Engineering and Science**, McGraw-Hill, 2014

Metcalf & Eddy, **Ingeniería de aguas residuales : tratamiento, vertido y reutilización**, McGraw-Hill, 1998

Acosta, J.A. et al., **Introducción a la contaminación de suelos**, Mundi-prensa, 2017

Complementary Bibliography

Tchobanoglous, G., **Gestión integral de residuos sólidos**, McGraw-Hill, 1996

Nemerow, N. L., **Tratamiento de vertidos industriales y peligrosos**, Diaz de Santos, 1998

Baird, C y Cann M., **Química Ambiental**, Reverté, 2014

Kiely, G., **Ingeniería Ambiental: fundamentos, entornos, tecnología y sistemas de gestión**, McGraw-Hill, 2001

Castells et al., **Reciclaje de residuos industriales: residuos sólidos urbanos y fangos de depuradora**, Díaz de Santos, 2009

Albergaria, J.M. and Nouws H.P.A., **Soil remediation**, Taylor and Francis, 2016

Sharma, H. D., and Reddy, K. R., **Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies**, John Wiley & Sons, 2004

Wark and Warner, **Contaminación del aire: origen y control**, Limusa, 1996

Jonker, G. y Harmsen, J., **Ingeniería para la sostenibilidad**, Reverté, 2014

Azapagic, A. and Perdan S., **Sustainable development in practice: Case studies for engineers and scientists**, Wiley, 2011

Reddy, K.R., Cameselle, C. and Adams, J.A., **Sustainable Engineering: Drivers, Metrics, Tools, and Applications**, Wiley, 2019

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Chemical technology/V12G360V01606
Chemistry: Chemistry/V12G380V01205

Other comments

Recommendations:
To enroll in this subject is necessary to have passed or be enrolled in all subjects of previous courses to the course that is located this subject.

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 teaching methodologies planned will be maintained, although they would be adapted to remote teaching.

The " lectures" would be online, via the Remote Campus, Faitic or any other platform that the University of Vigo wouldprovide to the academic staff.

Of all " laboratory practices " initially planned, those non-experimental ones would be maintained, while the others would bereplaced by on-line practices.

* Non-attendance mechanisms for student attention (tutoring)
Tutoring would be online, in the teacher's "virtual office" or by e-mail. In any case, students should previously arrange withtheir teacher (by e-mail) the tutoring date

* Modifications (if applicable) of the contents
In a virtual context, the three experimental practices would be replaced by online ones, maintaining the same contents.

=== ADAPTATION OF THE TESTS ===

In a virtual context, no changes would be required in the assessment criteria, or in the weighting of each test, in relation towhat is established for a presential assessment. Nor would it be necessary to make any changes in the type of tests .

Therefore, the assessment criteria are maintained, adapting the tests, if necessary and as indicated in the Rector'sResolution, to the telematic resources made available to the teaching staff.

IDENTIFYING DATA				
Tecnoloxía térmica				
Subject	Tecnoloxía térmica			
Code	V12G360V01704			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Cerdeira Pérez, Fernando			
Lecturers	Cerdeira Pérez, Fernando Pequeño Aboy, Horacio			
E-mail	nano@uvigo.es			
Web				
General description				

Competencias	
Code	
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CG5	CG5 Coñecementos para a realización de medicións, cálculos, valoracións, taxacións, peritaxes, estudos, informes, planes de labores e outros traballos análogos.
CG6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
CG7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
CG11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
CE7	CE7 Coñecementos de termodinámica aplicada e transmisión de calor. Principios básicos e a súa aplicación á resolución de problemas de enxeñaría.
CT2	CT2 Resolución de problemas.
CT7	CT7 Capacidade de organizar e planificar.
CT9	CT9 Aplicar coñecementos.
CT10	CT10 Aprendizaxe e traballo autónomos.
CT17	CT17 Traballo en equipo.
CT20	CT20 Capacidade para comunicarse con persoas non expertas na materia.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Capacidade para coñecer, entender, utilizar e deseñar sistemas enerxéticos aplicando os principios e fundamentos da termodinámica e da *trasmisión de calor.	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20
Comprender os aspectos básicos da combustión	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20
Comprender os aspectos básicos de motores térmicos	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20
Comprender os aspectos básicos do funcionamento dunha central térmica	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20

Contidos	
Topic	
1-INTRODUCIÓN	1.Problemática da Enerxía. A sociedade e a utilización da enerxía 2. Produción e consumo de enerxía
2- COMBUSTIÓN	1. Introdución 2. Tipos de combustión 3. Aire mínimo ou teórico 4. Exceso de aire de combustión 5. Fumes da combustión 6. A combustión incompleta 7. Diagramas de combustión 8. Rendemento da combustión
3-AIRE HÚMIDO	1. Introdución 2. Índices de humidade 3. Entalpía do aire húmido 4. Punto de rocío 5. Temperatura de saturación adiabática 6. Temperatura do bulbo húmido 7. Psicrométrico: Diagramas do aire húmido 8. Mestura de 2 ou mais aires húmidos 9. Mestura dunha masa de aire con auga, vapor e/ou calor 10. Procesos de acondicionamento de aire
4-INTRODUCIÓN AOS MOTORES TÉRMICOS	1. Clasificación dos motores térmicos 2. Funcionamento dos motores de combustión interna alternativos (MCIA) 3. Partes dos MCIA 4. Nomenclatura e parámetros fundamentais 5. Ciclos teóricos 6. Ciclos reais
5-MÁQUINAS TÉRMICAS	1. Máquinas térmicas. Xeneralidades 2. Ciclo Rankine 3. Ciclo Rankine con rexeneración 4. Turbinas de gas 5. Queimadores 6. Caldeiras: definición e tipoloxía 7. Eficiencia enerxética 8. Deseño de sistemas de Calor e ACS en edificación
6-TECNOLOXÍA DAS CENTRAIS TÉRMICAS	1. Tecnoloxía das centrais térmicas de vapor 2. Tecnoloxía das centrais de ciclo combinado 3. Tecnoloxía das centrais nucleares 4. Coxeneración
7- INSTALACIÓNS DE CLIMATIZACIÓN	1. Introdución 2. Ciclo de refrixeración 3. Bomba de calor 4. Compoñentes da bomba de calor 5. Características de funcionamento 6. Deseño de sistemas de climatización. 7. Eficiencia enerxética
8- FONTES DE ENERXÍA RENOVABLES DE INTERESe INDUSTRIAL	1. O potencial das enerxías renovables 2. A enerxía solar térmica. 3. A biomasa e combustibles residuais (R.S.U.).

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	21	21	42
Prácticas de laboratorio	4.5	0	4.5
Resolución de problemas	8	12	20
Prácticas con apoio das TIC	4.5	0	4.5
Saídas de estudo	9	0	9
Traballo tutelado	6	64	70

*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	Explicación maxistral clásica en lousa apoiada con presentación en transparencias, vídeos e calquera material que o docente considere útil para facer comprensible o temario da materia.

Prácticas de laboratorio	Realización de prácticas de laboratorio aplicadas. As actividades consistirán no desmonte de motores térmicos, medición de emisións...
Resolución de problemas	Resolución de exercicios e casos prácticos necesarios para a preparación das clases de teoría.
Prácticas con apoio das TIC	Resolución de exercicios mediante o apoio de programas informáticos.
Saídas de estudo	Visitas a instalacións que permitan coñecer os equipos a nivel industrial que se explican nas clases.
Traballo tutelado	Realización de traballos tutelados individuais e/ou en grupo. Dentro desta actividade inclúese a presentación dos devanditos traballos ante o grupo e a súa posterior avaliación.

Atención personalizada

Methodologies	Description
Lección maxistral	
Prácticas de laboratorio	
Resolución de problemas	
Traballo tutelado	

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas	Exame final escrito de teoría e problemas.	80	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT9 CT10
Traballo tutelado	Entrega das memorias dos traballos realizados e presentación oral dos mesmos. Resolución de problemas e preguntas cortas durante o curso.	20	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20

Other comments on the Evaluation

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizado, e outros) considérase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no actual curso académico será de suspenso (0.0).

Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula de exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0.0).

Bibliografía. Fontes de información

Basic Bibliography

Moran M.J.; Shapiro H.N., **Fundamentos de termodinámica técnica**, Editorial reverté, S.A.,

Incropera, F.P. et al, **Principles of heat and mass transfer**, 7th ed., international student version, Hoboken, N.J. : John Wiley,,

Múñoz Domínguez, M.; Rovira de Antonio, A.J., **Ingeniería Térmica**, UNED,

Complementary Bibliography

Agüera Soriano, J., **Termodinámica lógica y Motores Térmicos**, Ciencia 3,

Heywood, J.B., **Internal combustion engines fundamentals**, McGraw-Hill,

Payri, F.; Desantes, J.M., **Motores de combustión interna alternativos**, Reverté,

Recomendacións

Subjects that it is recommended to have taken before

Física: Física I/V12G360V01102
Física: Física II/V12G360V01202
Matemáticas: Cálculo I/V12G360V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G360V01204
Termodinámica e trasmisión de calor/V12G360V01405

Other comments

Para matricularse nesta materia é necesario superar ou ben matricularse de todas as materias dos cursos inferiores ao curso en que está situada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

Plan de Continxencias

Description

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.

Mantéñense tódalas metodoloxías docentes. As tutorías poderanse realizar telemáticamente.

IDENTIFYING DATA				
Electrical systems				
Subject	Electrical systems			
Code	V12G360V01705			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language				
Department				
Coordinator	Parajo Calvo, Bernardo José Villanueva Torres, Daniel			
Lecturers	Parajo Calvo, Bernardo José			
E-mail	berpc@uvigo.gal dvillanueva@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Analizar, deseñar e simula-lo funcionamento dos siistemas eléctricos. Coñecer e interpreta la normativa utilizada pra calcular instalaciones eléctricas industriaes.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE21	CE21 Knowledge of electric systems of power and their applications
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT10	CT10 Self learning and work.
CT14	CT14 Creativity.
CT16	CT16 Critical thinking.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
New	CG3	CE21	CT2 CT6 CT10 CT14 CT16 CT17
(*)Documentación, elaboración, presentación y defensa del proyecto de una instalación		CE21	CT2 CT6 CT10 CT17

Contents	
Topic	
Systems of Electrical Energy	Introduction to the systems of electrical energy. The electrical sector Spanish. Operation of the electrical system Spanish: balance between production and consumption. Centres of Control of Electrical Network of Spain. Maps of network. Zones of distribution in Spain and small distributors. Quality of the Electrical Service. Indexes of quality of the Service.
Networks of Distribution in Low Tension	Elements of the aerial networks of *BT. Execution of the networks on façade and on supports. Subterranean networks of *BT. Put to earth and continuity of the neutral. Criteria of dimensioning of the wires of *BT. Tackled: general box of protection and line *repartidora. Forecast of loads and factors of simultaneity.

Elements of the Systems of Electrical Energy.	Introduction to the general description of the systems. *Aparamenta Electrical. Parameters of the electrical lines: resistance, inductance and *capacitancia. Model of the electrical line. Model of transformer of power. Model of the alternator. Preparation of the model of an electrical system in values by unit.
Centres of Transformation for Distribution	Diagrams and constitution of Centres of transformation. Systems of protection. Put to earth of the Centres. Switches, *seccionadores and fusible. *Pararrayos. Interconnection *pararrayos-*trafo. Picture of *BT: interconnections *trafo-picture of *BT. Protection against the environmental aggression.
Study of the Operation of the System: Flow of Loads	Introduction. Radial networks and *malladas. Solution to the flow of loads: method of Gauss-*Seidel. Control and operation of the system: structure, controls of frequency and of tension, tertiary control.
Protection of the Systems of Power.	Characteristics of the currents of *cortocircuito: method of calculation. (JOIN-IN 60909). Analysis of the *cortocircuitos *trifásicos balanced and unbalanced (JOIN-IN-21239). Criteria of protection of the electrical system Spanish. Elements of protection against overload and *cortocircuitos: automatic and fusible switches. *Sobretensiones: Origin and mechanism of propagation. Coordination of the isolation: protection against the *sobretensiones (JOIN-IN 60071-1-2).
Industrial installations in Drop and Half tension.	Elements of the installations: symbology, electrical diagrams, electrical wires, devices of control and protection, electrical pictures, fusible, *contactores and relays. Compensation of the reactive energy: harmonic and filters
Luminothcnics And Installations of Illumination.	Foundations of luminothecnics. Elements of the installations of lighted up. Efficiency of the luminous sources. Harmonic and lighted up

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	30	38	68
Problem solving	4	12	16
Laboratory practical	4	12	16
Mentored work	4	30	34
Objective questions exam	2	2	4
Essay questions exam	2	2	4
Laboratory practice	2	2	4
Essay	2	2	4
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Exhibition of the cores of the subjects, followed of the convenient explanation to favour his understanding. Motivation of the interest by the knowledge of the matter.
Problem solving	Understanding of the models applied to justify the behaviour of the elements of the Electrical System. Application of the suitable procedures to evaluate his performance.
Laboratory practical	Practical application of the concepts learnt in theory. Know the elements and the procedures that employ in real electrical installations.
Mentored work	Deepening of the knowledge of the legal rule that affects to the design of the technical application. Documentation of solution adopted and justification of his opportunity for the security of the Surroundings: environment, users and installations.

Personalized assistance	
Methodologies	**Description**
Lecturing	Attention to questions and doubts posed by the student in the development of the classes
Problem solving	Attention to questions and doubts posed by the student in the development of the classes
Mentored work	Attention to questions and doubts posed by the student in the development of the classes

Laboratory practical	Attention to questions and doubts posed by the student in the development of the classes

Tests	**Description**
Objective questions exam	Attention to questions and doubts posed by the student regarding the development of the proof of evaluation
Essay questions exam	Attention to questions and doubts posed by the student regarding the development of the proof of evaluation
Essay	Attention to questions and doubts posed by the student regarding the development of the proof of evaluation
Laboratory practice	Attention to questions and doubts posed by the student regarding the development of the proof of evaluation

Assessment

	Description	Qualification	Evaluated Competencess		
Lecturing	Teaching of theoretical contents	0			
Problem solving	Examples and cases type	0			
Laboratory practical	Practical application of theoretical concepts	0			
Mentored work	(*)Exemplos de traballos e/ou proxectos a *reaizar	0			
Objective questions exam	Answer to the questionnaires to evaluate the knowledges of the matter.	20	CG3	CE21	
Essay questions exam	Justification and documentation of the cases proposed.	40	CG3	CE21	CT2 CT10
Laboratory practice	Delivery of memories of practices and/or results of the same	20	CG3	CE21	CT6 CT10 CT16 CT17
Essay	Documentation and justification of the central cores of the project. Preparation of diagrams and figures. Clarity of the editorial of the text. Sources of documentation used.	20	CG3	CE21	CT2 CT6 CT10 CT14 CT16 CT17

Other comments on the Evaluation

To surpass the subject, it is necessary to obtain a mark upper or the same to 50% and that any of the four parts was evaluated underneath of the 30 % of the maximum mark of each part. In the case that a student do not reach the minumum in any of the parts, his/her final mark would be fail (4.0). The students that renounce to his/her continuous assessment, will have the opportunity to pass the subject in a final exam, with the same parts and with the same weights as for the rest of students. The evaluations of each one of the parts will be kept along the same academic course, but this will not be true for the following ones. Ethics commitment: it is expected that the student has a suitable behaviour. In the case a non-proper behaviour is detected (copy, plagiarism, unauthorised use of electronic devices, and others) it would be considered that the student will not have the necessary requirements to surpass the subject. In this case, the mark in the current course will be a fail (0.0).

Sources of information

Basic Bibliography

Barrero, Fermín, **Sistemas de Energía Eléctrica.**, 2006,

Gómez Expósito y otros, **Análisis y Operación de Sistemas de Energía Eléctrica**, 2002,

D.P. Kothari e I.J. Nagrath,, **Sistemas Eléctricos de Potencia**, 2008,

Stevenson, Willian y Grainger John J,, **Análisis de sistemas eléctricos de potencia**, 2004,

Complementary Bibliography

Cuadernos Técnicos, **Reglamento Electrotécnico para BT**, 2008,

Cuadernos Técnicos, **Aparatos de protección y maniobra. La instalación eléctrica**, 2010,

Manual Ténico 189, **Maniobra y protección de las baterías de condensadores de MT**, 2002,

Unión-Fenosa Distribución, **CENTRO DE TRANSFORMACIÓN INTEMPERIE CTI**, 2010,

UNESA, **METODO DE CALCULO Y PROYECTO DE INSTALACIONES DE PUESTA A TIERRA PARA CENTROS DE TRANSFORMACIÓN CONECTADOS A REDES DE TERCERA CATEGORÍA**, 1989,

COMITE DE DISTRIBUCIÓN, **GUÍA TÉCNICA SOBRE CÁLCULO, DISEÑO MEDIDA DE LAS INSTALACIONES DE PUESTA A TIERRA EN REDES DE DISTRIBUCIÓN**, 1985,

MT 2.33.35, **DISEÑO DE PUESTAS A TIERRA EN APOYOS DE LAAT DE TENSION NOMINAL IGUAL O INFERIOR A 20 kV**, 2010,

IT.0110.ES.RE.PTP, **PROYECTO TIPO LÍNEAS ELÉCTRICAS AÉREAS DE BAJA TENSIÓN**, 2011,
Distribución, **PROYECTO TIPO LÍNEAS ELÉCTRICAS AÉREAS HASTA 20kV**, 2010,
MT 2.41.22, **RED AEREA TRENZADA DE BAJA TENSION**, 2009,
MT 2.21.60, **LÍNEA AÉREA DE MEDIA TENSIÓN Simple circuito con conductor de aluminio acero**, 2010,

Recommendations

Subjects that continue the syllabus

Electrical components in vehicles/V12G360V01902
Final Year Dissertation/V12G360V01991

Subjects that it is recommended to have taken before

Basics of circuit analysis and electrical machines/V12G360V01302
Applied electrotechnics/V12G360V01501
Electrical machines/V12G360V01605

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				
Control e automatización industrial				
Subject	Control e automatización industrial			
Code	V12G360V01801			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4	2c
Teaching language	Castelán			
Department	Enxeñaría de sistemas e automática			
Coordinator	Manzanedo García, Antonio			
Lecturers	Manzanedo García, Antonio			
E-mail	amanza@uvigo.es			
Web				
General description	Nesta materia preséntanse os conceptos básicos do control dixital en sistemas industriais así como as técnicas de análises, deseño e integración de proxectos de automatización.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CE24	CE24 Coñecementos de regulación automática e técnicas de control, e a súa aplicación á automatización industrial.
CT9	CT9 Aplicar coñecementos.
CT16	CT16 Razoamento crítico.
CT17	CT17 Traballo en equipo.

Resultados de aprendizaxe			
Learning outcomes		Competences	
Coñecementos xerais sobre o control dixital de sistemas dinámicos, das principais ferramentas de simulación de sistemas *muestreados	CG3		
Capacidade para deseñar sistemas de regulación e control dixital.		CE24	CT9
Habilidade para a concibir, desenvolver e *modelar sistemas automáticos.		CE24	CT9 CT16
Capacidade de analizar as necesidades dun proxecto de automatización e fixar as súas especificacións.			CT9 CT16 CT17
Capacidade de *dimensionar e seleccionar un autómata *programable industrial para unha aplicación específica de automatización así como determinar o tipo e características dos sensores e *actuadores necesarios.		CE24	CT9 CT16
Capacidade de traducir un modelo de funcionamento a un programa de autómata.		CE24	CT9
Ser capaz de integrar distintas tecnoloxías (electrónicas, eléctricas, *neumáticas, etc.) nunha única automatización.	CG3	CE24	CT9 CT17

Contidos	
Topic	
TEMA 1.- Sistemas de control dixital.	1.1 Esquemas de control por computador. 1.2 Secuencias e sistemas discretos. 1.3 Transformada Z. 1.4 Función de transferencia en z. 1.5 Ecuacións en diferenzas.
TEMA 2.- Análise de sistemas muestreados de control.	2.1 Mostraxe. 2.2 Reconstrución. 2.3 Sistemas muestreados. 2.4 Estabilidade. 2.5 Análise de resposta transitoria. 2.6 Análise de resposta permanente.
TEMA 3.- Síntese de reguladores digitales.	3.1 Discretización de reguladores continuos. 3.2 Reguladores PID discretos.

TEMA 4.- Autómatas Programables Industriais (PLCs)	4.1 Principio de funcionamento. 4.2 Memoria de Entradas e Memoria de Saídas. 4.3 Ciclo de funcionamento do autómata. Tempo de ciclo. 4.4 Programación estruturada. Tipos de módulos de programa.
TEMA 5.- Linguaxes normalizadas para a programación de autómatas.	5.1 Programación de autómatas co Standard IEC 61131. 5.2 Tipos de Datos Numéricos. Limitacións. Conversión. 5.3 Programación avanzada en Diagrama de Funcións e Diagrama de Contactos. Ampliación do conxunto de instrucións coñecidas.
TEMA 6.- Supervisión e Control de Procesos Industriais.	6.1 Tratamento de sinais analóxicos de E/S no autómata. 6.2 Modelado de sistemas de supervisión e/ou control. 6.3 Do modelo funcional ao programa de autómata. 6.4 Integración de Tecnoloxías.
P1. Matlab e Simulink para Sistemas Discretos.	Repaso e ampliación do programa Matlab e Simulink para a análise e deseño de sistemas de control.
P2. Introdución aos Sistemas Dixitais.	Procedementos de Mostraxe e Reconstrución. Influencia do período de mostraxe.
P3. Análise Dinámica de Sistemas Dixitais.	Obtención da resposta temporal dun sistema discreto. Implantación de Ecuacións en Diferenzas para a simulación de sistemas.
P4. Síntese de Reguladores Discretos.	Discretización de reguladores continuos: comparación dos diversos métodos de discretización. Implantación dun PID discreto.
P5. Tratamento de sinais analóxicos no Autómata.	Realización dun programa sinxelo de autómata para comprobar o tratamento e manexo de sinais analóxicos de E/S nun Autómata Programable.
P6. Supervisión de Procesos con sinais analóxicos.	Modelado e implantación da Supervisión dun proceso sinxelo que teña varios sinais analóxicos de entrada.
P7. Supervisión de Procesos con sinais analóxicos.	Modelado e implantación da Supervisión dun proceso máis complexo con varios sinais analóxicos de entrada, distintas zonas de traballo e alarmas.
P8. Supervisión e Control de Procesos con sinais analóxicos.	Modelado e implantación da Supervisión e Control de procesos no que estean implicadas sinais analóxicos, tanto de entrada como de saída coas súas Leis de Control.

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	1	0	1
Lección maxistral	22	22	44
Resolución de problemas	10	20	30
Prácticas de laboratorio	18	27	45
Exame de preguntas de desenvolvemento	4	26	30

*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 de a materia a os alumnos: competencias, contidos, planificación, metodoloxía, atención personalizada, avaliación e bibliografía.
Lección maxistral	Desenvolveranse en os horarios fixados por a Escola. Consistirá en unha exposición e desenvolvemento por parte de o profesor de os temas que constitúen o contido de a materia. Durante o seu desenvolvemento alentarase a participación activa de o alumno. Será necesario que logo o alumno dedique un tempo aproximadamente igual a a duración de a sesión para asimilar e sentar os conceptos explicados e que lle servirá como preparación para a seguinte sesión.
Resolución de problemas	Durante as sesións de aula, cando resulte oportuno, procederase a a resolución de problemas e/ou exercicios que faciliten a comprensión de os contidos de a materia, ou que sirvan para desenvolver e aplicar os contidos apresos. O alumnado deberá resolver exercicios similares para adquirir as capacidades necesarias.
Prácticas de laboratorio	Actividades de aplicación de os coñecementos adquiridos en as clases de teoría e situacións concretas que poidan ser desenvolvidas/simuladas en o laboratorio de a asignatura.

Atención personalizada

Methodologies	Description
Lección maxistral	En as clases de aula en que se imparta teoría se fomentara a participación de o alumnado, podendo interromper a exposición si algún punto non quedou suficientemente claro.
Resolución de problemas	En as clases de aula en as que se resolvan exercicios se fomentara especialmente a participación de o alumnado, cando non comprenda algún paso, ou suxerindo melloras e solucións alternativas.

Prácticas de laboratorio	En as clases de laboratorio farase un seguimiento máis próximo de os grupos de prácticas, axudando a os que vaian un pouco máis lentos e suscitando novos retos ou melloras en o seu desenvolvemento a os máis avantaxados.
Actividades introdutorias	A primeira clase de a asignatura ten moita importancia, e debe ser o suficientemente aclaratoria e reveladora para o alumnado de o que vai aprender en a asignatura e a onde se pretende chegar ao final de a mesma.

Tests	**Description**
Exame de preguntas de desenvolvemento	Aquí os alumnos deberán demostrar os coñecementos adquiridos en a asignatura, resolvendo basicamente exercicios de o tipo que se desenvolveron en o aula e que eles mesmos implantaron en o laboratorio. Insistirase en a importancia de a solución correcta, pero tamén en a xustificación de o proceso de chegar a a mesma.

Avaliación

	Description	Qualification	Evaluated Competencess		
Prácticas de laboratorio	Valorarase cada práctica de laboratorio entre 0 e 10 puntos, en función do cumprimento dos obxectivos fixados no enunciado da mesma e da preparación previa e actitude do alumnado. Cada práctica terá unha *ponderación distinta sobre a nota final de prácticas. Así mesmo, controlarase e valorará o aproveitamento das prácticas por parte do alumnado. Nalgunha das prácticas poderase esixir a entrega dos resultados da mesma.	30	CG3	CE24	CT9 CT16 CT17
Exame de preguntas de desenvolvemento	Exame final dos contidos da materia, que incluirá cuestións teóricas, problemas e exercicios.	70	CG3	CE24	CT9 CT16

Other comments on the Evaluation

PRÁCTICAS:

- A asistencia a todas as sesións de prácticas é Obrigatoria, excepto para os alumnos cuxa renuncia a a Avaliación Continua sexa oficialmente admitida.

- Realizarase unha Avaliación Continua de o traballo de o alumnado en as sesións de prácticas a o longo de o cuatrimestre. Si un alumno non prepara adecuadamente as prácticas e/ou descoñece os coñecementos básicos explicados en clase para a realización de a mesma, obterá directamente a cualificación de suspenso con a mínima nota en dita práctica.

- Si a o longo de as sesións de prácticas reglamentadas o traballo de o alumno é insuficiente e non consegue o Aprobado en prácticas, terá as prácticas Suspensas para a 1ª convocatoria.

- Si supera o exame escrito en a 2ª convocatoria o alumno deberá examinarse de prácticas si non as ten aprobadas de a 1ªconvocatoria.

- Tamén deberán examinarse de prácticas, en a mesma convocatoria en que superen o exame escrito, os alumnos cuxa renuncia a a Avaliación Continua sexa oficialmente admitida.

CUALIFICACIÓN:

- Para a consideración de Presentados "" ou "Non presentados" a unha convocatoria terase únicamente en conta a participación en a proba escrita.

- En as probas escritas poderase establecer unha puntuación mínima en un conxunto de preguntas/exercicios para superar o mesmo.

- Para aprobar a materia débense superar ambas partes, tanto o programa de prácticas (obtendo como mínimo o 33% de a puntuación asignada a as prácticas) como a proba escrita (50% de a puntuación asignada), obténdose en principio a nota total segundo a porcentaxe 30%-70% indicado anteriormente.

- En o caso de os Suspensos por non alcanzar algún de os mínimos establecidos ou non aprobar o exame escrito ou as prácticas, a nota final que figurará en o acta obterase de a expresión **0.7*(Nota Prácticas +0.7*(Nota Exame Escrito))** de tal forma que nunca poderá superar os 4.5 puntos.

Compromiso ético:

Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (por exemplo copia ou plagio, utilización de aparellos electrónicos non autorizados, e outros), considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Ademais solicitarase a aplicación de o Reglamento Disciplinario de a

Escola a o alumno en cuestión.

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

K. Ogata, **Sistemas de Control en Tiempo Discreto**, 2ª edición, Prentice-Hall, 1996

Guía usuario STEP7, SIEMENS,

Diagrama de Funciones (FUP) para S7-300 y S7-400, SIEMENS,

Diagrama de Contactos (KOP) para S7-300 y S7-400, SIEMENS,

Recomendacións

Subjects that it is recommended to have taken before

Fundamentos de automática/V12G360V01304

Other comments

Requisitos: Para matricularse en esta materia é necesario superar ou ben haber cursado todas as materias de os cursos inferiores a o curso en que está situada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán de esta guía.

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 ===

As metodoloxías docentes e as probas de avaliación levarán a cabo, si é necesario, adaptándoas aos medios *telemáticos que se poñan a disposición dos profesores e alumnos, ademais da documentación que se poida proporcionar por *FAITIC, *email e outras plataformas que tamén se poñan a disposición de profesores e alumnos.

* Metodoloxías docentes que se manteñen

Como principio básico tratarase de non modificar os contidos nin os resultados da aprendizaxe dos alumnos, evidentemente todo iso supeditado aos medios *telemáticos dispoñibles mentres dure a situación de continxencia e aos dereitos fundamentais de alumnos e profesor.

* Metodoloxías docentes que se modifican

Impartición de docencia (de aula): Cando non sexa posible a docencia de aula presencial tentarase, na medida do posible, cubrir os máximos contidos da Guía Docente facendo uso dos medios *telemáticos que a Universidade de Vigo poña a disposición de alumnos e profesor, non utilizando en ningún caso medios aos que non poidan acceder por falta de equipos *hardware, licencias software ou enlaces de comunicacións tanto os alumnos matriculados como o profesor, e en calquera caso nunca obrigando a ningún deles a renunciar aos seus dereitos fundamentais.

Prácticas de laboratorio (a realizar con equipos físicos concretos en laboratorio): Sempre se tentará que se realicen de forma presencial, aínda que haxa que reducir o número de sesións e tamén reducir o número de alumnos por sesión para cumprir coa normativa establecida en cada momento polas autoridades pertinentes en materia de sanidade e seguridade. Si baixo ningún concepto puidesen ser realizadas as prácticas de forma presencial, e cos mesmos criterios que na impartición de docencia non presencial, as prácticas que poidan substituírse por outra actividade, equivalente en esforzo e dedicación tanto para o profesor como para o alumno, serán substituídas. As que non poidan substituírse posporanse ou anularán total ou parcialmente.

* Mecanismo non presencial de atención ao alumnado (*tutorías)

*Tutorías: No caso de non poder ser presenciais adaptaríase o horario adaptándoo á situación de emerxencia e os medios dispoñibles. Segundo criterio do profesor, realizaríanse telefonicamente, por *email, ou algún outro medio *telemático accesible a todas as partes.

* Avaliación

Criterios xerais para avaliación non presencial (Continua e Final): Manteranse os criterios (contidos, condicións e pesos) indicados na Guía Docente, no entanto poderán adecuarse a realización das probas, en caso de ser necesario e por indicación en Resolución Reitoral, aos medios postos pola *UVIGO a disposición do profesorado e todos os alumnos para a realización das mesmas de forma non presencial.

No caso particular da Avaliación Continua (realizada normalmente a través das prácticas presenciais en laboratorio): Co agravante de ser necesarios equipos *hardware e/ou licencias software que os alumnos non dispoñen normalmente nos seus domicilios, e tendo en conta que esas prácticas avaliables componse aproximadamente dun 50% de traballo previo en casa e un 50% de implantación práctica no laboratorio, si a *UVIGO non proporcionase os medios necesarios aos alumnos, principalmente en forma de licenzas software, a única solución sería que o alumno fixese o traballo en casa e o profesor avaliase só esa parte, anulando (ou pospondo) a parte de proba no laboratorio.

Avaliacións Finais de 1ª e 2ª convocatoria e Final de Carreira: Si non puidesen celebrarse probas presenciais, nin sequera adaptándoas á normativa sanitaria do momento, realizaríase unha avaliación simultánea e *telemática dos alumnos en cada convocatoria, debendo realizala os alumnos de forma individual e nos seus domicilios habituais. A proba consistiría en exporlles de forma *secuencial exercicios (a través de *FaiTIC ou medio similar que a *UVIGO proporcione) a realizar nun tempo máximo cada un e devolvendo o alumno os resultados a través do propio *FaiTIC ou por correo electrónico, segundo considere o profesor para cada tipo de exame. Todo iso podería ser modificado si a *UVIGO pon a disposición de profesorado e alumnos algún outro medio que asegure o adecuado control do exame para que os alumnos non utilicen medios ilícitos (nin copien nin se comuniquen entre si durante os exames).

IDENTIFYING DATA				
Fundamentos de administración de empresas				
Subject	Fundamentos de administración de empresas			
Code	V12G360V01802			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4	2c
Teaching language	Castelán			
Department	Organización de empresas e márketing			
Coordinator	Urgal González, Begoña			
Lecturers	Urgal González, Begoña			
E-mail	burgal@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Esta materia tiene por objeto dar a conocer los aspectos fundamentales de la administración de empresas y la importancia del sistema de información económico-financiero, para analizar la situación patrimonial y competitiva de la empresa, de manera que sirva de apoyo a la toma de decisiones empresariales			

Competencias
Code
CG9 CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
CT5 CT5 Xestión da información.
CT8 CT8 Toma de decisións.
CT9 CT9 Aplicar coñecementos.

Resultados de aprendizaxe		
Learning outcomes		Competences
Coñecer a base sobre a que se apoia a análise económica financeiro da empresa. Coñecer as ferramentas que se utilizan na análise económica financeira. Coñecer os aspectos básicos de xestión económica financeira.	CG9	CT5 CT8 CT9
Coñecemento sobre os fundamentos da empresa e das ferramentas específicas para a súa análise financeira.	CG9	CT5 CT8 CT9
Coñecemento sobre os fundamentos da administración e dirección de empresas e os procesos de xestión	CG9	CT5 CT8 CT9

Contidos	
Topic	
TEMA 1. A EMPRESA E A DIRECCIÓN DE EMPRESAS	A empresa e a súa contorna. A propiedade, a dirección e o goberno da empresa. A estrutura organizativa da empresa.
TEMA 2. A INFORMACIÓN CORPORATIVA	Información xerada pola empresa. Información financeira e non financeira.
TEMA 3. ANÁLISE ESTRUTURAL	Análise patrimonial. Equilibrio financeiro. Análise baseado en ratios financeiras.
TEMA 4. ANÁLISE DA RENDIBILIDADE E DOS CUSTOS	Rendibilidade. Apalancamento financeiro. Estrutura de custos. Marxe bruto. Umbral de rendibilidade. Apalancamento operativo. Produtividade.
TEMA 5. A TOMA DE DECISIÓNS NA EMPRESA	Métodos de apoio á toma de decisións. Risco e incerteza. Decisións secuenciais. Decisións de investimento e financiamento.
TEMA 6. DIRECCIÓN COMERCIAL DA EMPRESA	O proceso de marketing. As ferramentas de marketing.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	64.5	97
Prácticas de laboratorio	18	18	36
Exame de preguntas obxectivas	2	4	6
Exame de preguntas de desenvolvemento	3	8	11
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente

	Description
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas e casos de estudo e exercicios que sirvan de complemento.
Prácticas de laboratorio	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedimentais relacionadas coa materia obxecto de estudo.

Atención personalizada

Methodologies	Description
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas e casos de estudo e exercicios que sirvan de complemento.
Prácticas de laboratorio	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedimentais relacionadas coa materia obxecto de estudo.

Avaliación

	Description	Qualification	Evaluated Competencess	
Prácticas de laboratorio	Resolución de problemas e/ou exercicios mediante a aplicación de rutinas, procedementos e fórmulas a partir da información dispoñible.	20	CG9	CT5 CT8 CT9
Exame de preguntas obxectivas	Proba tipo test de escolla múltiple sobre contidos teóricos e prácticos.	20	CG9	CT5 CT8 CT9
Exame de preguntas de desenvolvemento	Proba con cuestións teóricas e prácticas.	60	CG9	CT5 CT8 CT9

Other comments on the Evaluation

1. AVALIACIÓN CONTINUA

A avaliación continua é o sistema de avaliación principal. Esta consta dos seguintes elementos:

- **Proba de avaliación intermedia**. Esta proba será tipo test, desenvolverase no horario do bloque teórico, nunha data establecida ao comezo da docencia, e o seu contido será teórico e práctico. Este exame representará o **20% da cualificación final** da materia. Esta proba non é recuperable, é dicir, se un/unha alumno/a non pode realizala na data estipulada, a profesora non ten a obriga de repetila.
- **Prácticas**. O cumprimento das tarefas desenvolvidas durante as prácticas suporá o **20% da cualificación final** da materia. Avaliarase cada práctica desenvolvida polo alumno, sendo a nota total de prácticas, a media aritmética das notas obtidas nelas. As prácticas non son recuperables, polo tanto, se non se asiste a unha práctica, a nota desa práctica será cero.
- **Exame final**. O exame que terá lugar na data oficial fixada na planificación docente do curso completará o **60% restante da cualificación final**. IMPORTANTE: É imprescindible neste exame obter unha puntuación mínima de 4, nunha escala de 0 a 10, para aprobar a materia. Este exame consta de dúas partes, unha parte teórica tipo test e outra práctica que incluirá unha serie de exercicios a desenvolver.

2. AVALIACIÓN NON CONTINUA

No caso de estudantes que renuncien expresamente á avaliación continua, realizarase un único exame, na data oficial fixada na planificación docente do curso, que dará a posibilidade de obter o 100% da nota. Este exame constará de dúas partes, unha parte teórica tipo test e outra práctica que incluirá unha serie de exercicios a desenvolver. IMPORTANTE: É unha condición necesaria, aínda que non suficiente, para aprobar a materia, obter na parte teórica unha puntuación mínima de 5, nunha escala de 0 a 10.

3. RECUPERACIÓN DE XULLO

O exame de recuperación de xullo será similar ao exame final. Os/as estudantes que optaron pola avaliación continua poderán elixir que a nota da materia sexa o 100% da puntuación obtida neste exame. Para iso, o/a alumno/a deberá avisar á profesora unha semana, como mínimo, antes do exame.

4. COMPROMISO ÉTICO

Espérase que o/a estudante presente un comportamento ético adecuado. No caso de detectar comportamentos non éticos

(copia, plaxio, uso de dispositivos electrónicos non autorizados e outros) considerarase que o/a estudante non cumpre os requisitos necesarios para aprobar a materia. Neste caso, a nota global do presente curso académico será un suspenso (0,0).

Bibliografía. Fontes de información

Basic Bibliography

Iborra Juan, M. y otros, **FUNDAMENTOS DE DIRECCIÓN DE EMPRESAS**, 84-9732-371-8, Thomson, 2007

Moyano Fuentes, J. y otros, **ADMINISTRACIÓN DE EMPRESAS. UN ENFOQUE TEÓRICO-PRÁCTICO**, 978-84-8322-752-7, Prentice Hall, 2011

Complementary Bibliography

Cuervo García, A., **INTRODUCCION A LA ADMINISTRACION DE EMPRESAS**, 978-84-4702-867-2, Civitas, 2008

Bueno Campos, E., **CURSO BÁSICO DE ECONOMÍA DE LA EMPRESA. UN ENFOQUE ORGANIZATIVO**, 978-84-3681-911-3, Pirámide, 2004

Recomendacións

Subjects that it is recommended to have taken before

Empresa: Introdución á xestión empresarial/V12G360V01201
Fundamentos de organización de empresas/V12G360V01305

Other comments

Para matricularse nesta materia é necesario ter superadas ou ben estar matriculado de todas as materias dos cursos inferiores ao curso no que está emprazada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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 ===

A actividade docente impartirase a través do Campus Remoto, empregando tamén a plataforma de teledocencia Moovi como reforzo, todo sen prexuízo de poder empregar medidas complementarias que garantan a accesibilidade dos estudantes aos contidos docentes.

As titorías realizaranse por medios telemáticos, de xeito asincrónico (correo electrónico) ou por videoconferencia, neste caso previa cita.

=== ADAPTACIÓN DA AVALIACIÓN ===

No caso de non poder realizar as probas presencialmente, manterase a mesma estrutura de avaliación (mesmas probas e mesmos pesos), pero as probas realizaranse a través dos medios telemáticos dispoñibles na Universidade de Vigo (Moovi, Campus remoto , etc.)

IDENTIFYING DATA				
Compoñentes eléctricos en vehículos				
Subject	Compoñentes eléctricos en vehículos			
Code	V12G360V01902			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Enxeñaría eléctrica			
Coordinator	López Fernández, Xosé Manuel			
Lecturers	López Fernández, Xosé Manuel			
E-mail	xmlopez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description				

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CT3	CT3 Comunicación oral e escrita de coñecementos.
CT5	CT5 Xestión da información.
CT10	CT10 Aprendizaxe e traballo autónomos.
CT17	CT17 Traballo en equipo.

Resultados de aprendizaxe		
Learning outcomes		Competences
Coñecer el desenvolvemento histórico e retos futuros de la rede eléctrica de abordo utilizada nos vehículos (*Kfz *Bornetz)	CG3	CT3 CT5 CT10 CT17
Coñecer as variantes de rede eléctrica de abordo co aumento de tensión.	CG3	CT3 CT5 CT10 CT17
Coñecer propiedades, funcionamento e compoñentes que proceden de a rede eléctrica de abordo tradicional en vehículos.	CG3	CT3 CT5 CT10 CT17

Contidos	
Topic	
Introdución.	Introdución. Tipos de vehículo. Historia do vehículo eléctrico. Perspectivas de futuro.
Esquemas eléctricos en vehículos.	Introducción. Instalación eléctrica. Esquemas eléctricos. Localización dos compoñentes eléctricos no esquema eléctrico. Principais circuítos que compoñen o esquema.
Compoñentes eléctricos de abordo.	Introducción. Sistemas eléctricos principais. Sistemas eléctricos auxiliares. Accionamiento. Tracción. Dispositivos auxiliares. Equipos de abordo. Sensores.

Tracción en vehículos eléctricos.	Introdución. Requisitos para a tracción eléctrica. Motor asíncrono. Motor síncrono. Motor de reluctancia. Motor de imáns permanentes. Control e accionamento. Aplicacións.
Sistemas de control e comunicación.	Introdución. Sistemas de comunicación: Elementos; Configuracións; Buses Sistemas de control: Estáticos; Dinámicos; Seguridade; Motor
Sistemas de almacenamento de enerxía.	Introducción. Baterías. Células de combustión. Supercondensadores. Volante de inercia Tendencias. Integración na red eléctrica
Sistemas de recarga e infraestrutura de soporte.	Introducción. Modos de recarga. Tipos de conectores. Infraestructura de soporte. Tipos de redes de alimentación. Enerxías alternativas. Arquitectura de un xestor de carga. Redes intelixentes.
Prácticas de laboratorio	Achegamento aos diferentes compoñentes eléctricos, análises e identificación dos mesmos.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	12	36	48
Saídas de estudo	10	10	20
Traballo tutelado	10	30	40
Presentación	10	32	42

*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 dos núcleos dos temas, seguida da explicación conveniente para favorecer a súa comprensión. Motivación do interese polo coñecemento da materia.
Saídas de estudo	Coñecemento dos procesos de fabricación de compoñentes relacionados coa materia e a súa diferenciación dentro do sector.
Traballo tutelado	Profundización no contido detallado da materia adoptando un enfoque estruturado e de rigor. Promover o debate e a confrontación de ideas.
Presentación	Exercitar recursos de análises e síntese dos traballos tutelados elaborados. Promover a adopción de aptitudes autocríticas e a aceptación de enfoques contrarios.

Atención personalizada

Methodologies	Description
Saídas de estudo	
Traballo tutelado	
Presentación	

Avaliación

Description	Qualification	Evaluated Competencess

Traballo tutelado	Valoración dos traballos individuais e en equipo, materializados nunha memoria.	60	CG3	CT3 CT5 CT10 CT17
Presentación	Presentación individual dos resultados dos traballos tutelados, onde se puntuará: Motivación polo tema. Claridade da exposición. Medios utilizados. Resposta ás dúbidas e suxestións presentadas. Claridade de conceptos Precisión da información Achegas Resultados Conclusións	40	CG3	CT3 CT5 CT10 CT17

Other comments on the Evaluation

El alumno/a podrá escoger entre una de las dos opciones, Opción A (Evaluación Final) o Opción B (Evaluación continua), para su evaluación, según se detalla a continuación. Opción A A esta Opción A podrá optar cualquier alumno/a matriculado/a en la asignatura. La evaluación de los conocimientos adquiridos por el alumno/a se hará de forma individual, y sin la utilización de ningún tipo de fuente de información, en un único examen escrito que englobará toda la materia recogida en el Temario relativa al Aula, Laboratorio y Salidas de estudios o Prácticas de campo. Los exámenes coincidirán con las convocatorias oficiales correspondientes. Para superar la asignatura, será necesario obtener una puntuación igual o superior al 50% de la puntuación asignada. Opción B A esta Opción B podrán optar sólo los alumnos/as que participen de forma presencial en todos los ejercicios y actividades que se propongan en el Aula, para realizar tanto de forma individual como en equipo, y que además asistan a todas y cada una de las actividades de Laboratorio y Salidas de estudio o Prácticas de campo programadas. Dichas actividades consistirán en: Trabajos tutelados individuales y en equipo, evaluados a través de una memoria escrita, con un peso de 60%. Presentaciones individuales y en equipo de los resultados de los trabajos tutelados, con un peso de 40%. Para superar la asignatura, es condición necesaria, pero no suficiente, obtener como mínimo el 30% de la nota máxima asignada a cada una de las partes, tanto en Trabajos tutelados (mínimo 2%), como en Presentaciones (mínimo 1,20%). La materia estará superada cuando la puntuación total (Trabajos tutelados + Presentaciones) resulta una nota final mínima del 50%. En aquellos casos en los que a pesar de no superar el 30% de la nota máxima asignada de alguna de las partes Trabajos tutelados y/o Presentaciones, resulte una nota igual o mayor al 50% requerido, la nota final se traducirá en un 30%, lo que significará un suspenso.

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizado, e outros) considérase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no actual curso académico será de suspenso (0.0). Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula de exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0.0).

Bibliografía. Fontes de información

Basic Bibliography

TOM DENTON, **AUTOMOBILE ELECTRICAL AND ELECTRONIC SYSTEMS**, THIRD EDITION, Elsevier Butterworth-Heinemann, 2004

Bosch, **Automotive Handbook**, 8th Edition

K. T. Chau, **ELECTRIC VEHICLE MACHINES AND DRIVES DESIGN, ANALYSIS AND APPLICATION**, 978-1-118-75252-4, 2015, Wiley,

Eli Emadi, **Advanced Electric Drive Vehicles**, 978-1-4665-9770-9, 2015, CRC Press Taylor & Francis Group,

William B. Ribbens, **Understanding Automotive Electronics. An Engineering Perspective**, 978-0-12-810434-7, Elsevier Inc., 2017

Complementary Bibliography

José Domínguez, Esteban, **Sistemas de Carga y arranque**, 2011,

Sánchez Fernández, Enrique, **Circuitos Eléctricos Auxiliares del Vehículo**, 2012,

Esteban José Domínguez y Julián Ferrer, **Circuitos eléctricos auxiliares del vehículo**, 2012,

Nicolas Navet, F. Simonot-Lion, **Automotive Embedded Systems Handbook**, 978-0-8493-8026-6, CRC Press Taylor & Francis Group, 2009

Bruno Scrosati, J. Garche, W. Tillmetz, **Advances in Battery Technologies for Electric Vehicles**, 978-1-78242-377-5, Elsevier Ltd., 2015

Recomendacións

Subjects that continue the syllabus

Traballo de Fin de Grao/V12G360V01991

Subjects that it is recommended to have taken before

Fundamentos de teoría de circuítos e máquinas eléctricas/V12G360V01302
Electrotecnia aplicada/V12G360V01501

Other comments

Para matricularse nesta materia é necesario superar ou ben estar matriculado de todas as materias dos cursos inferiores ao curso en que está situada esta materia.

En caso de discrepancia, prevalecerá a versión en castelán desta guía.

Plan de Continxencias

Description

No caso de que a asistencia presencial do alumnado ás clases estea legalmente limitada total ou parcialmente, adoptaranse as directrices sinaladas pola Universidade ou organismo competente, tendo que:
- Contido: Mantense.
- Planificación: Mantense.
- Metodoloxía: Emprego de medios acordes coas directrices da Universidade ou organismo competente.
- Atención personalizada: As sesións de *tutorización poderán realizarse por medios alternativos baixo a modalidade de concertación previa, e acorde coas directrices da Universidade ou organismo competente.
- Avaliación: Emprego de medios acorde coas directrices da Universidade ou organismo competente.
- Bibliografía: Non se modifica respecto da modalidade presencial.

IDENTIFYING DATA				
Technical english 1				
Subject	Technical english 1			
Code	V12G360V01903			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	English			
Department				
Coordinator				
Lecturers				
E-mail				
Web	http://moovi.uvigo.gal/			
General description	This course aims at providing students with a systematic adequacy to develop the appropriate skills for communicating in Technical English at level A2 according to the Common European Framework of Reference for Languages (CEFR). As far as possible, students will be monitored so as to accommodate to each individual needs.			

Competencies	
Code	
CG10	CG10 Ability to work in a multidisciplinary and multilingual environment.
CT1	CT1 Analysis and synthesis.
CT4	CT4 Oral and written proficiency in a foreign language.
CT7	CT7 Ability to organize and plan.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.
CT18	CT18 Working in an international context.

Learning outcomes	Competences	
To encourage students to use the English language within the engineering context, and the benefits and usefulness of the English language when applying their grammatical, lexical, and cultural knowledge.	CG10	CT1 CT4 CT7 CT10 CT17 CT18
To improve students' sense of linguistic awareness of English as a second language, the grammatical and lexical mechanisms and types of expressions.	CG10	CT1 CT4 CT7 CT10 CT17 CT18
Improving students' listening and reading skills, as well as their speaking and writing skills.	CG10	CT1 CT4 CT7 CT10 CT17 CT18
To upgrade students' grammatical and lexical notions of the English language, and the comprehension of basic Technical English structures.	CG10	CT1 CT4 CT7 CT10 CT17 CT18
Promoting students' critical autonomy for the comprehension and understanding of texts, dialogues and oral presentations.	CG10	CT1 CT4 CT7 CT10 CT17 CT18

Contents

Topic	
1. English grammar	UNIT 1
2. Vocabulary/Use of English	Reading: Batteries and Flowbatteries.
3. Technical-scientific language	Reading: Parts of a car.
4. Speaking	Speaking: Describing components and materials.
5. Listening	Speaking: Dates, mathematical expressions, web sites and email
6. Reading comprehension	addresses, chemical formula.
7. Writing	Listening: Where's that Darn Battery.
8. Direct and inverse translation of specific parts	Listening: Adsense Making Money Online.
of the discourse	Grammar: Present Simple.
1. English grammar	UNIT 2
2. Vocabulary/Use of English	Reading: CO2 and the Greenhouse Effect.
3. Technical-scientific language	Reading: Maintaining your Car.
4. Speaking	Speaking: Describing easy shapes and forms, and dimensions.
5. Listening	Listening: Light Pollution.
6. Reading comprehension	Listening: MIT Seeks Moral to the Story of Self-driving Cars.
7. Writing	Writing: Easy paragraph writing.
8. Direct and inverse translation of specific parts	Grammar: Passive voice.
of the discourse	
1. English grammar	UNIT 3
2. Vocabulary/Use of English	Reading: Job Qualities for an Engineer.
3. Technical-scientific language	Speaking: Expressing one own's qualities, and personal characteristics and
4. Speaking	abilities.
5. Listening	Listening: Mobile phones.
6. Reading comprehension	Grammar: Relative Clauses.
7. Writing	Writing: Dividing a text into types of paragraphs.
8. Direct and inverse translation of specific parts	
of the discourse	
1. English grammar	UNIT 4
2. Vocabulary/Use of English	Reading: Repairing a Broken Wall Socket.
3. Technical-scientific language	Speaking: Advantages and disadvantages of the different generation
4. Speaking	power systems.
5. Listening	Listening: How do Nuclear Power Plants work?
6. Reading comprehension	Writing: A report.
7. Writing	Grammar: Adverbs of sequence; conditional sentences; connectors:
8. Direct and inverse translation of specific parts	contrast, reason, purpose, and result.
of the discourse	
1. English grammar	UNIT 5
2. Vocabulary/Use of English	Reading: Windfarms.
3. Technical-scientific language	Speaking: Comparison and contrast.
4. Speaking	Listening: Manipulating Glass Properties.
5. Listening	Listening: IT-related Problems.
6. Reading comprehension	Writing: Letter of Motivation.
7. Writing	Grammar: Verb tenses expressing future; time adverbials; using "enable",
8. Direct and inverse translation of specific parts	"allow", "permit", "make", and "cause".
of the discourse	
1. English grammar	UNIT 6
2. Vocabulary/Use of English	Reading: Difference Engines.
3. Technical-scientific language	Speaking: Expressing hypothetical future.
4. Speaking	Listening: Industrial Processing of Canned Corn.
5. Listening	Grammar: Order of adjectives.
6. Reading comprehension	
7. Writing	
8. Direct and inverse translation of specific parts	
of the discourse	
1. English grammar	UNIT 7
2. Vocabulary/Use of English	Reading: Properties of Materials.
3. Technical-scientific language	Reading: Land and Off-shore Windfarms.
4. Speaking	Speaking: Expressing cause and effect.
5. Listening	Listening: Innovations is Great (1).
6. Reading comprehension	Listening: e-trading and e-selling.
7. Writing	Writing: Paragraph divisions for descriptions.
8. Direct and inverse translation of specific parts	Grammar: Expressing cause and effect.
of the discourse	

1. English grammar 2. Vocabulary/Use of English 3. Technical-scientific language 4. Speaking 5. Listening 6. Reading comprehension 7. Writing 8. Direct and inverse translation of specific parts of the discourse	UNIT 8 Reading: Superconductivity in Orbit. Speaking: Expressing likelihood. Listening: Innovation is Great (2). Listening: Geothermal Energy. Writing: Description of a process. Grammar: Likelihood.
1. English grammar 2. Vocabulary/Use of English 3. Technical-scientific language 4. Speaking 5. Listening 6. Reading comprehension 7. Writing 8. Direct and inverse translation of specific parts of the discourse	UNIT 9 Reading: Water is Everything. Reading: Man-made Building Materials. Speaking: Materials used in industry: purpose and cause. Listening: Fuel Cells. Grammar: Adjectives: present participle, past participle.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	8	15	23
Autonomous problem solving	8	10	18
ICT suppoted practices (Repeated, Dont Use)	5	8	13
Mentored work	4	16	20
Problem and/or exercise solving	6	10	16
Objective questions exam	6	10	16
Essay	4	15	19
Oral exam	8	16	24

*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 at presenting the subject, taking contact with the students and gathering information in relation to their previous knowledges of the subject.
Lecturing	Explanation of the linguistic contents and its application (Use of English) in the learning process and the acquisition of the contained theoretical contents of the subject.
Autonomous problem solving	Activities focused on dealing with exercises related to the subject. Students develop the skills and the fulfillment of exercises related with the linguistic skills (Use of English) in Technical English and the communicative skills; especially the oral expression (Speaking).
ICT suppoted practices (Repeated, Dont Use)	The practice activities in connection to the four communicative skills: oral understanding (Listening), oral expression (Speaking), reading comprehension (Reading), and written expression (Writing), as well as the linguistic skill (Use of English) in Technical English. These activities are done individually or in group.
Mentored work	The analysis and resolution of practical exercises in relation to grammar and vocabulary combined with the communicative skills. Students autonomously perform tasks within and outside the classroom as homework; especially the communicative task of written expression (Writing).

Personalized assistance

Methodologies	Description
Introductory activities	General guidance to students on the subject concerning goals and how to achieve them. Exploring motivations and interests of the students. Indications on assignments and exercises to be done during the course, dates of assignment deliveries and the examination dates and how to achieve goals on the subject. Indicating that no tutorial will be done on the telephone or internet (electronic post, Skype, etc.). In case of any doubt, students will have to contact directly with the professor in the classroom or during tutorial hours.
Mentored work	Activities carried out in the classroom and during tutorials in order to supervise the learning process of the entrusted tasks and in relation to the communicative skill of written expression (Writing) and the linguistic skill (Use of English) in the English language.
Autonomous problem solving	This activity is directed to boost the realization of the diverse exercises related with the communicative skills and the linguistic skill in the application of the theoretical concepts of the language in practice. Detecting the difficulties in the learning process and lessening the different levels of the English language of each student with the rest of the participants in the course.

Lecturing	The personalized attention in lecturing aims at the correct comprehension and the encouragement given to students in the classroom and during tutorials during the learning process of the theoretical concepts of the subject; as well as making indications on the practice of exercises to be carried out and giving advice about the performance so as to successfully achieve a pass in this subject.

Tests	Description
Oral exam	The aim of the personalized attention of the oral examination centers in the preparation, encouragement and the supervision of the oral expression (Speaking) in the classroom during the course and previous to the oral examination. The purpose of this activity is to encourage students to express not only with relevance and quality in relation to engineering and its specific vocabulary but also with linguistic correctness.

Assessment

	Description	Qualification	Evaluated Competencess	
Problem and/or exercise solving	Evaluation of the theoretical concept of the Technical English language and its application. Performance of practical exercises in relation to the linguistic skill (Use of English).	20	CG10	CT4 CT10 CT18
Objective questions exam	Evaluations of communicative skill of oral understanding (Listening) with contents related to engineering (16%). Evaluations of the communicative skill of reading comprehension (Reading) with contents related to engineering (16%).	32	CG10	CT1 CT10 CT18
Essay	Evaluations of the communicative skill of the written expression (Writing).	16	CG10	CT1 CT4 CT7 CT10 CT18
Oral exam	Evaluations of the communicative skill of oral expression (Speaking) in relation to the linguistic skill and vocabulary in the field of engineering.	32	CG10	CT1 CT4 CT7 CT10 CT17 CT18

Other comments on the Evaluation

1. Particular considerations

There are two assessment systems. Choosing a system excludes the other.

1.1. Continuous assessment

To qualify under the system of continuous evaluation, students are required to attend 80% of the total lecture hours with academic progress and involvement. Therefore students not attending the total hours of the percentage established will lose this option. Students making use of the continuous evaluation counts 100% in the assessment of their final grade with the course assignments and testings. The failure to complete the assignments requested along the course will be counted as a zero (0.0). The assignments requested must be delivered or submitted by the deadlines and dates marked beforehand.

1.2. Final assessment

Students making use of the only evaluation or final examination sit for examination with a final overall assessment, taking place on the oficial date established by the School of Industrial Engineering. To this end, students should consult the School web site, where the examination date and time are specified in accordance to students subject attendance either Campus or City Centre (Torrecedeira).

2. Final subject assessment result

2.1. Continuous assessment

The final mark for this subject is computed taking into consideration all the skills practiced during the course. Therefore each of them counts as follows:

Listening: 16%.

Speaking: 32%.

Reading: 16%.

Writing: 16%.

On the other hand, Use of English examination sums up 20%.

So the final mark will be established adding the communicative skills and Use of English tests to sum up 100%, being 5 (five) the mark necessary to obtain a pass in all skills and Use of English tests.

Students, who in the publication of the first assessment record, have scored a non-pass in one or several skills, must retake the part or parts for the corresponding failed skills in the July exam of the current course to obtain a pass. In case of a second non-pass in July, students must undergo examination for all skills in future courses. Therefore, those passed parts will not be taken into account in the future or subconsequent to course to the current one .

Partial or total plagiarism in any of the assignment or activity will result in an automatic non-pass on the subject. Plead ignorance of what plagiarism is, will not exempt students of their responsibility in this regard.

2.1. Final Assessment

The only assessment is computed as follows: Listening: 16%. Speaking: 32%. Reading: 16%. Writing 16%, whereas Use of English examination sums up 20%.

So the final mark will be established adding skills and Use of English test to sum up 100%, being 5 (five) the mark necessary to obtain a pass in all skills and short answer tests.

Regarding July assessment (second call assessment) continuous evaluation students will undergo examination for the specific parts of the subject contents not completed; while students of the only examination who failed in the previous exam notification (first call) must undergo an assessment of the total subject contents (100%).

Both continuous assessment and final assessment will take into account not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

3. Additional considerations

3.1. Forbidden materials or devices

In addition, during the examinations no dictionaries, notes or electronic devices (mobile phones, tablets, PCs, etc.) will be allowed.

3.2. Information and deadlines

It is students responsibility to check FAITIC or their e-mails to be kept up to date on the uploaded teaching materials, as well as to be aware of examination or submission dates.

3.3. Erasmus students

All the comments here indicated also pertain to Erasmus students. In the event of not being able to access information on FAITIC, students have to contact the teacher to solve the problem.

3.4. Ethical commitment. Students are requested to present an adequate ethical behaviour. In case of detecting an unethical behaviour (coping, plagiarism, use of not authorized electronic devices, and others) will be considered that the student does not meet the requisites necessary to pass the subject. In this case, the global qualification in the present academic course will be of a fail (0.0).

Sources of information
Basic Bibliography
Beigbeder Atienza, Federico, **Diccionario Técnico Inglés/Español; Español/Inglés**, Díaz de Santos,
Collazo, Javier, **Diccionario Collazo Inglés-Español de Informática, Computación y otras Materias**, McGraw-Hill,
Hornby, Albert Sidney, **Oxford Advanced Learner s Dictionary**, Oxford University Press,
Jones, Daniel, **Cambridge English Pronouncing Dictionary with CD**, Cambridge University Press,
Hewings, Martin, **English Pronunciation in Use, Advanced with Answers, Audio CDs and CD-ROM**, Cambridge University Press,
Murphy, Raymond, **English Grammar in Use 4th with Answers and CD-ROM**, Cambridge University Press,
Picket, Nell Ann; Laster, Ann A. & Staples Katherine E., **Technical English: Writing, Reading and Speaking**, Longman,
Complementary Bibliography
www.agendaweb.org,
www.bbc.co.uk/worldservice/learningenglish/,
www.edufind.com/english/grammar,

www.voanews.com/specialenglish,
iate.europa.eu, **Technical English Dictionary**,
www.howjsay.org, **A free online Talking English Pronunciation Dictionary**,

Recommendations

Other comments

We recommend students, who wish to take part in this course, to have a prior A1 level in English so as to reach the A2 level, according to the Common European Framework of Reference for Languages of the Council of Europe.

Requisites:
To register in this subject it is necessary to have passed or to be registered for all the subjects of the lower-division courses to the course where this subject is placed.

We also recommend continuous assessment due to the methodology used to practice and consolidate the learning process of the subject contents. Therefore, the active participation of students is essential to pass the Technical English subject requisites.

It is advisable to check the School's lectures timetable so as to avert imcompatibility of attendance with any other subject. Therefore students will not be permitted to sit for continuous evaluation if there is overlap.

In order to avoid damaging computers, students will not be allowed to take drinks or food into the classroom. If the ingestion of liquid or food is necessary, students must show an official medical prescription.

Contingency plan

Description

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.

When face-to-face teaching is not possible, teaching methodologies will be adapted to the electronic means that are given to the teachers and to the documents provided through FAITIC and other platforms, e-mail, etc.

All assessable activities and tests will be done remotely. Assessment criteria remain the same, although the examination process will be adapted to the electronic means provided to the teachers, if needed and when ruled by the Dean.

Any changes will be notified to the concerned students properly, on time and in a detailed manner.

Counselling will be scheduled virtually (e-mail and virtual office)

IDENTIFYING DATA				
Technical english 2				
Subject	Technical english 2			
Code	V12G360V01904			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	English			
Department				
Coordinator	García de la Puerta, Marta			
Lecturers	García de la Puerta, Marta			
E-mail	mpuerta@uvigo.es			
Web				
General description	This course aims at providing students with a systematic adequacy to develop the appropriate skills for communicating in Technical English at level B1 according to the Common European Framework of Reference for Languages (CEFR). As far as possible, contents will be adapted to the level of each student.			

Competencies	
Code	
CG10	CG10 Ability to work in a multidisciplinary and multilingual environment.
CT1	CT1 Analysis and synthesis.
CT4	CT4 Oral and written proficiency in a foreign language.
CT7	CT7 Ability to organize and plan.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.
CT18	CT18 Working in an international context.

Learning outcomes	Competences	
To improve students' sense of linguistic awareness of English as a second language, the grammatical and lexical mechanisms and types of expressions.	CG10	CT1 CT4 CT7 CT9 CT10 CT17 CT18
Improving students' listening and reading skills, as well as their speaking and writing skills in Technical English at intermediate level (B1).	CG10	CT1 CT4 CT7 CT9 CT10 CT17 CT18
To upgrade students' grammatical and lexical notions of the English language, and the comprehension of basic Technical English structures at B1 level.	CG10	CT1 CT4 CT7 CT9 CT10 CT17 CT18
To encourage students to use the English language within the engineering context, and the benefits and usefulness of the English language when applying their grammatical, lexical, and cultural knowledge.	CG10	CT1 CT4 CT7 CT9 CT10 CT17 CT18

Promoting students' critical autonomy for the comprehension and understanding of dialogues and texts written in Technical English.	CG10	CT1 CT4 CT7 CT9 CT10 CT17 CT18

Contents	
Topic	
UNIT 1. Technical Vocabulary for Engineers	UNIT 1 Increasing knowledge of technical vocabulary and grammar; learning how to use technical vocabulary and grammar accurately and effectively. Expressing facts and numbers (mathematical expressions, dates, amounts, internet symbols and abbreviations); saying calculations, results and approximations. Describing dimensions and specifications; phrases related to length, width, thickness, etc.
UNIT 2. Professional Presentations	UNIT 2 General guidelines for delivering oral presentations: identifying what makes a professional presentation effective. Presenting information in an organized and engaging way. Sharing data in charts and graphs: Presenting data; talking about trends and figures; describing and referring to visual aids; describing cause and consequence; cause-effect verbs. Structuring a presentation: How to create the perfect introduction, main body paragraphs and conclusion; language for linking the parts, for focusing and emphasizing your point; language for recapping and returning to your point. Non-verbal communication. Illustrating the importance of body language and voice power. Ways of emphasizing your message to communicate it clearly and persuasively. Presentation language: Using persuasive language in a presentation. Learning useful terminology and expressions that you can apply to professional presentations.
UNIT 3. Professional English in Use and Technical Writing	UNIT 3 Describing processes; verbs for describing stages of a process; time sequencers; active vs passive. Describing devices, mechanisms, components, inventions, innovations, positions of assembled components, etc. by its shape, properties, technical function, applications and material; explaining how technology works; verbs and adjectives to describe advantages and disadvantages; material properties vocabulary; machine part vocabulary; relative clauses; prepositions of position; verbs and nouns for describing design problems; cause and effect: "if" clauses. Writing and using Email at work: Learning a general organization pattern that works for many types of emails; learning about tone and formality in email writing style; identifying good and bad features: correcting errors; learning useful phrases, terminology and common email expressions for each part of the email.

UNIT 4. Applying for a Job	UNIT 4 Research and Preparation: Identifying the stages in the job application process; researching yourself; identifying your skills and experience; Job advertisement jargon. Writing an impressive CV: Considering different models of CV´s and digital application materials; creating a strong first impression; highlighting your key skills and strengths; highlighting your work experience; phrases for demonstrating your strengths and weaknesses; avoiding common CV mistakes; phrases to give details of your personal characteristics, qualifications, skills, and professional experience; common CV verbs (action verbs); avoiding spelling mistakes, noun-phrases, etc. Writing effective cover letters: Identifying features of cover letters; structuring a cover letter; phrases for opening a cover letter; talking about the job you are applying for; demonstrating skills and experience; matching skills and experience to the job; closing expressions; formal expressions. Successful interviews: Preparing for the interview; making a positive first impression; dealing effectively with interview questions; talking about yourself; demonstrating interest and motivation; giving details of your skills and experience; positive adjectives; avoiding common mistakes; providing you have done research.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Mentored work	4	16	20
Autonomous problem solving	8	10	18
ICT suppoted practices (Repeated, Dont Use)	5	8	13
Lecturing	8	15	23
Problem and/or exercise solving	6	10	16
Essay	4	15	19
Objective questions exam	3	5	8
Oral exam	8	16	24
Objective questions exam	3	5	8
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	Activities aimed at presenting the subject, getting in touch with students and gathering information about their previous knowledge on the topic.
Mentored work	Analysis and resolution of practical exercises related to the grammatical and lexical contents, and to the communication skills. The students must develop these activities in an autonomous way, specially those homework activities concerning Writing skills.
Autonomous problem solving	Activities in which problems are presented and/or exercises related to the subject. The student must develop the analysis and resolution of problems and/or activities concerning the four communicative skills at an individual level, as well as the technical English linguistic skill (Use of English); specially those ones concerning Speaking.
ICT suppoted practices (Repeated, Dont Use)	Practice of the four communicative skills: listening, speaking, reading and writing, as well as the technical English linguistic skill (Use of English) at an individual or group level.
Lecturing	Explanation of linguistic contents and their application (Use of English) for the learning and acquisition of the theoretical contents of the subject.

Personalized assistance	
Methodologies	**Description**
Introductory activities	The objective of the introductory activities is to provide general guidance on the subject; to promote learning strategies; to make general notes about the work and exercises, deadlines for the submission of work and the exam dates; and to give advice on how to pass the subject. It is important to know that no tutorials will be done on the telephone or internet (email, Skype, etc.). In case of any doubt or comment, students should contact directly with the professor in the classroom or during tutorial hours.
Autonomous problem solving	This activity seeks to help students with the practical exercises related to the communicative skills and the linguistic skills and their application for the learning and acquisition of the theoretical contents of the subject.

Mentored work	Practice of the different exercises in relation to the communicative skills and linguistic skills in order to apply English theoretical concepts.
Lecturing	The personalised attention for the master class is focused on the attention of students in the classroom and during tutorial hours. It focuses on the correct comprehension and promotion of the learning of the subject□s theoretical concepts, as well as on providing guidance on work and practical exercises and on giving advice on how to pass the subject.

Tests	**Description**
Oral exam	The objective of the personalised attention of the oral exam is focused on the preparation, promotion and supervision of the oral expression (Speaking) in the classroom during the course and before the exam. This activity seeks to help the students not only to express themselves with relevance and appropriateness using the topics and vocabulary from the field of engineering, but also with linguistic correction.

Assessment

	Description	Qualification	Evaluated Competencess	
Problem and/or exercise solving	Evaluation of theoretical concepts and their application. Resolution of practical exercises related to the linguistic skill (Use of English) of technical English.	20	CG10	CT7 CT10 CT18
Essay	Evaluation of the writing skill.	16	CG10	CT1 CT4 CT7 CT9 CT10 CT18
Objective questions exam	Evaluation of the listening skill with engineering-related contents.	16	CG10	CT4 CT9 CT10 CT18
Oral exam	Evaluation of the speaking skill with engineering-related vocabulary and topics.	32	CG10	CT1 CT4 CT7 CT10 CT17 CT18
Objective questions exam	Evaluation of the reading skill with engineering-related topics and vocabulary.	16	CG10	CT1 CT4 CT7 CT10 CT17 CT18

Other comments on the Evaluation

1. Particular considerations

There are two assessment systems: continuous or final. The selection of a system excludes the other.

1.1. Continuous assessment

In order to qualify for the system of continuous evaluation, students are required to attend 80% of the total lecture hours with academic progress and participation. Students not reaching that percentage will lose this option. The essays and tests done during the course will be worth 100 % of the final assessment for those students choosing the continuous evaluation. The non completion of the assignments requested during the course will be counted as a zero (0.0). The assignments requested must be delivered or submitted by the deadlines and dates marked beforehand.

1.2. Final assessment

Students choosing the final examination will have to take a final overall tests that will take place on the official date established by the School of Industrial Engineering. To this end, students should consult the school's website, where the examination date and time are specified in accordance to students' centre (campus or city) in which they took the subject.

2. Subject's final grade

2.1. Continuous assessment

The final mark for this subject is calculated taking into consideration all the skills practised during the course. Therefore,

each one of them is given the following weight in the final grade:

Listening: 16%.

Speaking: 32%.

Reading: 16%.

Writing: 16%.

On the other hand, the practical exercises related to the grammatical and lexical contents and to the communicative skills, and the application of linguistic contents (Use of English) will have a weight of 20% of the mark obtained.

Therefore, both parts (theory and practice) will add up to 100%, being 5 (five) the required mark to pass the subject.

In order to pass the course through continuous assessment, it is necessary to obtain a minimum mark of 4/10 in all the parts. If not, the subject's average final mark will be a maximum of 4/10, even when the exam's arithmetic average is above that.

In order to completely pass the course, students who obtained a mark below 4 in any of the parts on the first edition of records will have to resit the failed part(s) in an exam in July of the current academic year. If the course is not pass in the second call, students will have to resit the exam of the whole course in future calls, except for the next assessment call in September.

Partial or total plagiarism in any of the assignments or activities will result in an automatic fail of the subject. To claim ignorance of what plagiarism is, will not exempt students of their responsibility in this regard.

2.2. Final Assessment

The final assessment is calculated as follows:

Listening: 16%.

Speaking: 32%.

Reading: 16%.

Writing 16%

On the other hand, the practical exercises related to the grammatical and lexical contents and to the communicative skills, and the application of linguistic contents (Use of English) will have a weight of 20% of the mark obtained. Therefore, both parts (theory and practice) will add up to 100%, being 5 (five) the required mark to pass the subject.

Regarding July's test, continuous assessment students will take the exam for the specific parts failed, while final assessment students who failed must take an exam including all the skills and linguistic contents of the subject.

Both continuous and final assessment will take into account not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

3. Additional considerations

3.1. During the examinations no dictionaries, notes or electronic devices (mobile phones, tablets, PCs, etc.) will be allowed.

3.2. It is students' responsibility to check all the resources in MOODLE and/or their e-mails, as well as to be aware of examination or submission dates.

3.3. All the above-mentioned comments also pertain to Erasmus students. In the event of not being able to access MOODLE, students must contact the professor to solve the problem.

3.4. Students are requested to have an adequate ethical behaviour. In case of detecting an unethical behaviour (coping, plagiarism, use of not authorized electronic devices, and others), it will be considered that the student does not meet the requisites necessary to pass the subject. In this case, the overall qualification in the current academic course will be of a fail (0.0).

Sources of information
Basic Bibliography
Beigbeder Atienza, Federico, **Diccionario Técnico Inglés/Español; Español/Inglés**, Díaz de Santos,
Collazo, Javier, **Diccionario Collazo Inglés-Español de Informática, Computación y otras Materias**, McGraw-Hill,

Hornby, Albert Sidney, **Oxford Advanced Learner□s Dictionary**, Oxford University Press,
Jones, Daniel, **Cambridge English Pronouncing Dictionary**, Cambridge University Press,
Hancock, Mark, **English Pronunciation in Use: Intermediate**, Cambridge University Press,
Murphy, Raymond, **English Grammar in Use: A Self-Study Reference and Practice Book for Intermediate Students**, Cambridge University Press,
Picket, Nell Ann; Laster, Ann A. & Staples Katherine E., **Technical English: Writing, Reading and Speaking**, Pearson Limited Education,

Complementary Bibliography

www.agendaweb.org,
www.bbc.co.uk/worldservice/learningenglish/,
www.edufind.com/english/grammar,
www.voanews.com/specialenglish,
www.mit.edu, **Massachusetts Institute of Technology**,
www.iate.eu, **Eu's Multilingual Technical and Scientific Dictionary**,

Recommendations

Other comments

We recommend students to have some knowledge of English. This course will start from an A2 level and it will reach B1 level, according to the European Framework of Reference for Languages of the Council of Europe.

Requisites:

To register in this subject, it is necessary to have passed or to be registered for all the subjects of the lower courses.

We also recommend continuous assessment due to the methodology used to practise and consolidate the contents of the subject. Therefore, the active participation of students is essential to pass the Technical English subject.

It is advisable to check and compare this subject's timetable with the School's lectures timetables so as to avoid incompatibilities. Students will not be allowed to choose continuous assessment if there is an overlap with other subjects.

In order to avoid damaging the room's computer equipment, students will not be allowed to take drinks or food into the classroom. If the ingestion of liquids or food is due to medical reasons, students must show an official medical prescription.

Sending of emails or the using of mobile phones during the lessons means that the students will be expelled.

The student who does not comply with the information in the previous paragraph will not only be expelled, but s/he will also lose the opportunity to sit for continuous assessment.

In case of discrepancy, the Spanish version of this teaching guide will 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 (DOCNET).

When teaching at the campus is not possible, teaching methodologies will be adapted to the online means that are available to the teachers and to the documents provided through MOODLE, e-mail, etc.

The different exams and activities counted for the evaluation will be done online.

Assessment criteria will be maintained, while adjusting the way of carrying out the exams to the online means available to the teachers, if necessary and according to the Decision of the Rectorate.

Any changes will be announced in detail properly and on time to the affected students.

Office hours will be scheduled online (e-mail and online campus)

IDENTIFYING DATA				
Methodology for the preparation, presentation and management of technical projects				
Subject	Methodology for the preparation, presentation and management of technical projects			
Code	V12G360V01905			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cerqueiro Pequeño, Jorge			
Lecturers	Cerqueiro Pequeño, Jorge Comesaña Campos, Alberto			
E-mail	jcerquei@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of this course is to prepare the students to handle the methods, techniques and tools that are needed for the elaboration and management of technical documents in the industrial field of Engineering. It will also be sought to develop skills in the handling of information and communication technologies related to the professional field of the student's degree. Furthermore, the student skills to communicate properly the knowledge, procedures and results in the Industrial Engineering field will be strenghtened. An essentially practical approach will be used, based in the solution of specific application exercises -with guidance of the subject's lecturer- that will require to apply the theoretical contents of the course.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT7	CT7 Ability to organize and plan.
CT8	CT8 Decision making.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
CT13	CT13 Ability to communicate orally and in writing in the Galician language.
CT14	CT14 Creativity.
CT15	CT15 Objectification, identification and organization.
CT17	CT17 Working as a team.
CT18	CT18 Working in an international context.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes	
Learning outcomes	Competences

Utilization of methodologies, technics and tools for the organization and management of all technical documents other than engineering projects.	CG3	CE18	CT2 CT7 CT8 CT9 CT10 CT14 CT15 CT17
Skills in the utilization of information systems and in the communications in the industrial scope.			CT5 CT6 CT9 CT11 CT17
Skills to communicate properly the knowledge, procedures, results, abilities in the field of Engineering in Industry.			CT3 CT13 CT17 CT18 CT20

Contents	
Topic	
1. Types of usual documents in the distinct fields of the professional engineering activities.	1.1. Technical documents: Characteristics and components. 1.2. Types of technical documents according to their contents. 1.3. Types of technical documents according to their recipients and objectives.
2. Methodology for writing and presenting technical documentation: assessments, valuations, expert reports, studies, reports, dossiers and other similar technical works.	2.1. General aspects in elaborating and presenting technical documentation. 2.2. Elaboration of technical reports. 2.3. Elaboration of technical studies. 2.4. Elaboration of assessments, expert reports and valuations. 2.5. Elaboration of dossiers and other technical works. 2.6. Technical work in concurrent and/or collaborative engineering environments.
3. Techniques for research, analysis, evaluation and selection of technological information.	3.1. Typology of technological information. 3.2. Sources of technological information. 3.3. Information and communications systems. 3.4. Techniques for information research. 3.5. Methods for analyzing information. 3.6. Evaluation and selection of information.
4. Laws and regulations about documentation.	4.1. Applicable laws to technical documentation according to its specific field. 4.2. Other applicable regulations.
5. Processing of technical documentation.	5.1. Processing at Government Offices of technical documentation. 5.2. Legitimization and responsabilities in the processing of documentation before Government's Offices. 5.3. Processing of documentation: Concepts, procedures and specifics.
6. Presentation and verbal defence of technical documents.	6.1. Regulations in the elaboration of technical presentations. 6.2. Preparation for the verbal defence of technical documents. 6.3. Techniques and specific tools for the performance of public presentations.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	29.5	44.25	73.75
Laboratory practical	29.5	44.25	73.75
Laboratory practice	1.3	0	1.3
Problem and/or exercise solving	1.2	0	1.2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation by the lecturer of the contents of the topic to be studied, the theoretical bases and/or guidelines of a specific work, exercise or project to be developed by the student.

Laboratory practical	Activities that require applying theoretical knowledge to specific situations in order to acquire basic and procedural skills related to the topic that is being studied. These activities will be developed in special spaces with specific equipment (laboratories, computer rooms, etc.).

Personalized assistance

Methodologies	Description
Laboratory practical	Activities oriented to the application of knowledge to specific situations, and to acquire basic and procedimental skills related to the field of study. Rooms equiped with specific materials and resources will be used for these classes. An appropriate follow-up will be performed on student's work to verify that the best practices shown in theory classes are applied, and that the procedimental recommendations provided by the lecturer are followed. For all the teaching modalities considered in the Contingency Plan, the tutorial sessions can be carried out using IT tools (email, video-call, FAITIC forums, etc.) according to the modality of prior concertation of the virtual place, date and time.

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	Interdisciplinary exercises and problems -as close to real cases as possible- will be solved in groups of students, with lecturer orientation and enforcing active participation by the students.	55	CG3	CE18	CT2 CT3 CT5 CT7 CT8 CT9 CT10 CT13 CT14 CT15 CT17 CT18 CT20
Laboratory practice	Making of practical tests and exercises related to the subject's contents, in the scope of the personalised attention to students.	20	CG3	CE18	CT2 CT3 CT5 CT7 CT8 CT9 CT10 CT13 CT14 CT15 CT17 CT18 CT20
Problem and/or exercise solving	Groups of short answer questions related to the subject's contents, to check that the students have understood and assimilated the theoretical and practical contents.	25	CG3	CE18	CT2 CT3 CT7 CT8 CT9 CT11 CT14 CT15

Other comments on the Evaluation

Assessment of student's work - individually and/or in groups, either face-to-face or non-presential - will be carried out by the lecturer by weighting appropriatelly the different marks obtained in the activities that were proposed along this course.

Students may opt to follow this course either in the 'Continuous Evaluation' or in the 'Non-Continuous Evaluation' modalities. In both cases the grading of the course will be made according to a numerical system, using values from 0,0 to 10,0 pointsaccording to the current laws that are applicable (R.D. 1125/2003 of 5th September, BOE Nr. 224 of18th September). A minimum overall mark of 5,0 is required to pass this course.

For theFirst Announcement or Edition.

a) 'Continuous Evaluation' modality:

The final mark for the course will be calculated by combining the individual marks awarded in the assessment of the works proposed and elaborated in the practical classes (60% weight) along the term, with the mark awarded for the final test performed in the date stated by the School's Ruling (40% weight).

These marks will asess the behaviour and the implication of the student both in class and in the realisation of the different programmed activities, plus the fulfillment of the deadlines for submitting the works that were proposed, and/or the presentation and defence of those works, etc.

Students not reaching the minimum value of 3,5 points out of 10 that are required for every section,they will either need to perform also the assessment in the SecondAnnouncement date, or to elaborate additional works or practical exercises to achievethe learning goals that were established for the concerned sections.

b) 'Non-ContinuousEvaluation' modality:

There is a two weeks time term after the starting date of the course for the concerned students to justify with documents that it is not possible for them to follow the regular process of continuous evaluation.

In order to pass this course, students renouncing to continuous evaluation will be obligued to perform a final test covering thewhole contents of the course, both theoretical and practical, including short questions, reasoning questions, problem solving and development of practical cases. The mark awarded to the student assessment will be the final mark for the course.

A minimum mark of 5,0 points out of 10,0 possible will be required to pass the course.

For theSecond Announcement or Edition.

Students who did not pass the course in the First Announcement,but that could have passed some specific parts of the theory or practical blocks,will be allowed to be assessed only regarding the failed parts, keeping the marks formerly awarded for the parts already passed, and applying the same assessment criteria to them.

Students wishing to improve their qualification, or students that failed the course on the First Announcement, will need to assist to the Second Announcement, where they will be assessed about the whole contents ofthe course, both theoretical and practical, including short questions, reasoning questions, problem solving and development of practical cases. Students are required to reach a minimum mark of 5,0 points out of 10,0possible to pass the course.

Ethical commitment:

It is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for theassessment tests is not allowed unless explicitly authorized. The fact ofintroducing unauthorized electronic device in the examination room will beconsidered reason for not passing the subject in the current academic year andwill hold overall rating (0.0).

Sources of information
Basic Bibliography
Aguado, David, **HABILIDADES PARA EL TRABAJO EN EQUIPO: PROGRAMA DE ENTRENAMIENTO**, 1ª, Ediciones Universidad Autónoma de Madrid, 2008
Álvarez Marañón, Gonzalo, **EL ARTE DE PRESENTAR: CÓMO PLANIFICAR, ESTRUCTURAR, DISEÑAR Y EXPONER PRESENTACIONES**, 1ª, Gestión 2000, 2012
Lannon, John M. and Gurak, Laura J., **TECHNICAL COMMUNICATION**, 13th, Pearson, 2013
Pringle, Alan S. and O'Keefe, Sarah S., **TECHNICAL WRITING 101: A REAL-WORLD GUIDE TO PLANNING AND WRITING TECHNICAL CONTENT**, 1st, Scriptorium Publishing Services, 2009
Complementary Bibliography
BIBLIOGRAFÍA BÁSICA:, **----------**, ----------,
Blair, Lorrie, **WRITING A GRADUATE THESIS OR DISSERTATION**, 1st, Sense Publishers, 2016
Brown, Fortunato, **TEXTOS INFORMATIVOS BREVES Y CLAROS: MANUAL DE REDACCIÓN DE DOCUMENTOS**, 1ª, Octaedro, 2003
Budinski, Kenneth G., **ENGINEER'S GUIDE TO TECHNICAL WRITING**, 1st, ASM International, 2001
Pease, Allan, **ESCRIBIR BIEN ES FÁCIL: GUÍA PARA LA BUENA REDACCIÓN DE LA CORRESPONDENCIA**, 1ª, Amat, 2007
BIBLIOGRAFÍA COMPLEMENTARIA:, **----------**, ----------,
Balzola, Martín, **PREPARACIÓN DE PROYECTOS E INFORMES TÉCNICOS**, 2ª, Balzola, 1996

Boeglin Naumovic, Martha, **LEER Y REDACTAR EN LA UNIVERSIDAD: DEL CAOS DE LAS IDEAS AL TEXTO ESTRUCTURADO**, 1ª, MAD, 2007
Calavera, J., **MANUAL PARA LA REDACCIÓN DE INFORMES TÉCNICOS EN CONSTRUCCIÓN: INFORMES, DICTÁMENES, ARBITRAJES**, 2ª, Intemac, 2009
Córcoles Cubero, Ana Isabel, **CÓMO REALIZAR BUENOS INFORMES: SORPRENDA CON INFORMES CLAROS, DIRECTOS Y CONCISOS**, 1ª, Fundacion Confemetal, 2007
García Carbonell, Roberto, **PRESENTACIONES EFECTIVAS EN PÚBLICO: IDEAS, PROYECTOS, INFORMES, PLANES, OBJETIVOS, PONENCIAS, COMUNICACIONES**, 1ª, Edaf, 2006
Himstreet, William C., **GUÍA PRÁCTICA PARA LA REDACCIÓN DE CARTAS E INFORMES EN LA EMPRESA**, 1ª, Deusto, 2000
Sánchez Pérez, José, **FUNDAMENTOS DE TRABAJO EN EQUIPO PARA EQUIPOS DE TRABAJO**, 1ª, McGraw-Hill, 2006
Williams, Robin, **THE NON-DESIGNER'S PRESENTATION BOOK**, 1st, Peachpit Press, 2009

Recommendations

Subjects that it is recommended to have taken before

Graphic expression: Fundamentals of engineering graphics/V12G320V01101
Technical Office/V12G320V01704

Other comments

Previously to the realisation of the final assesments, students should check in the FAITIC platform to know whether it is necessary for them to carry any particular documentation, materials, etc. into the exam room to perform the tests.

It is necessary that the student registered in this course, either has passed all courses of the former years, or is registered in the courses he's not passed yet.

Contingency plan

Description

In the face of the uncertain and unforeseeable evolution of the health alert caused by COVID-19, University of Vigo has established an exception planning that will be activated at the time the government offices and the own University mandate it. Such decision will be made based on safety, health and responsibility criteria, always guaranteeing the continuity of the teaching processes in a partial or full non-classroom scenario. Those already-planned steps will guarantee, at the moment it is required, the development of the teaching processes in a more streamlined and effective way as both the students and the lecturers will know about them beforehand (or with a broad anticipation), by means of the DOCNET standard institutional tool.

According to the instructions provided by the Vice-Rectorate for Learning Organization and Teaching Staff, the following three scenarios are required to be taken into account with their corresponding contingency level:

SCENARIO 1. Full-classroom modality.
All teaching activities will be carried out at the classroom, both for theory and laboratory classes, according to the typical way for the course in the years before 2020.

SCENARIO 2. Half-classroom modality.
In the case the half-classroom teaching modality is activated by the University government, such event will involve a reduction in the capacity of the usual teaching spaces where the full-classroom modality is developed. Because of that, as a first measure the School will provide the teaching staff of the course with the information regarding the new authorized capacities for such teaching spaces so that the teaching activities can be re-organized for the remaining time of the term. It must be pointed out that the necessary re-organization to implement will depend on the specific moment in the term in which this teaching modality is activated. The following guidelines will be followed in the re-organization or the teaching activities:

a) Communication. All students in the course will be informed through the FAITIC teaching portal on the specific conditions for the development of the teaching and the evaluation activities that remain until the end of the term.

b) Adaptation of the tutorial and personalized attention to students. The tutorial sessions may be carried out by means of IT tools (email, video-call, FAITIC forums, etc.), according to the modality of prior concertation of the date and time for the session in the lecturers virtual offices.

c) Classroom and non-classroom activities. From the teaching activities that remain until the end of the term, those that

could be carried out by all students in class need to be identified (prioritizing laboratory activities when possible), and those other that will be carried out remotely (theory classes are the ones that usually decrease in effectiveness less in this modality), to the effects of the planning of its efficient performance.

d) Teaching contents and learning goals. There will be no changes neither in the contents to be taught nor in the learning goals, as a consequence of this teaching modality.

e) Teaching schedule. The class timetable and the calendar of the different activities in the course will be maintained as initially planned and scheduled.

f) Bibliography or additional materials to facilitate self-learning. The teaching staff for the course will provide the students with the necessary learning materials to attend to the specific help needs of the students with respect to the course, according to the circumstances that turn out at any particular time, through the FAITIC portal.

With regard to the tools used for the teaching activities in the non-classroom modality, the CAMPUS REMOTO and FAITIC portals will be of preferential use, complemented if necessary with other solutions in order to address specific needs arising along the lecturing period.

SCENARIO 3. Non-classroom modality.
In the case the full non-classroom modality (discontinuation of all on-class learning and evaluation activities) is activated, the tools offered by the platforms currently available at University of Vigo -CAMPUS REMOTO and FAITIC- will be of preferent use. The specific conditions for the reo-organization to be carried out will depend of the particular time in the term in which such modality is mobilized. The following guidelines will be followed in the re-organization of the teaching activities:

a) Communication. All students in the course will be informed through the FAITIC teaching portal on the specific conditions for the development of the teaching and the evaluation activities that remain until the end of the term.

b) Adaptation and/or modification of the teaching methodologies. Even if the teaching methodologies for the course were fundamentally conceived towards the full-classroom modality, the teaching staff considers that they keep in essence their effectiveness in the non-classroom modality. That is why it is proposed to keep them as they are, even if special attention will be payed to their right development and results. Therefore, no changes will be made to the teaching methodologies initially defined for the course.

c) Adaptation of the tutorial and personalized attention to students. The tutorial sessions may be carried out by means of IT tools (email, video-call, FAITIC forums, etc.), according to the modality of prior concertation of the date and time for the session in the lecturers virtual offices.

d) Teaching contents and learning goals. There will be no changes neither in the contents to be taught nor in the learning goals, as a consequence of this teaching modality.

e) Teaching schedule. The class timetable and the calendar of the different activities in the course will be maintained as initially planned and scheduled.

f) Evaluation. No changes will be made neither to the evaluation tests, nor to their corresponding score weights, nor to their set dates.

g) Bibliography or additional materials to facilitate self-learning. The teaching staff for the course will provide the students with the necessary learning materials to attend to the specific help needs of the students with respect to the course, according to the circumstances that turn out at any particular time, through the FAITIC portal.

IDENTIFYING DATA				
Programación avanzada para a enxeñaría				
Subject	Programación avanzada para a enxeñaría			
Code	V12G360V01906			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Enxeñaría de sistemas e automática			
Coordinator	Camaño Portela, José Luís López Fernández, Joaquín			
Lecturers	Camaño Portela, José Luís López Fernández, Joaquín			
E-mail	joaquin@uvigo.es cama@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Aplicación práctica de técnicas actuais para a programación de aplicacións industriais para *computadores e dispositivos móbiles. Programación orientada a obxectos en Xava para sistemas *Windows e *Android.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE3	CE3 Coñecementos básicos sobre o uso e programación dos ordenadores, sistemas operativos, bases de datos e programas informáticos con aplicación en enxeñaría.
CT2	CT2 Resolución de problemas.
CT5	CT5 Xestión da información.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT7	CT7 Capacidade de organizar e planificar.
CT17	CT17 Traballo en equipo.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecementos informáticos avanzados aplicables ao exercicio profesional dos futuros enxeñeiros, con especial énfase nas súas aplicacións á resolución de problemas no ámbito da Enxeñaría	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Coñecer os fundamentos informáticos de diferentes paradigmas de programación (estruturada, modular, orientada a obxectos), as súas posibilidades, características e aplicabilidade á resolución de problemas no ámbito da Enxeñaría	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Capacidade para utilizar linguaxes e contornas de programación e para programar algoritmos, rutinas e aplicacións de complexidade media para a resolución de problemas e o tratamento de datos no ámbito da Enxeñaría	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Coñecer os fundamentos do proceso de desenvolvemento de software e as súas diferentes etapas	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Capacidade para desenvolver interfaces gráficas de usuario	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17

Contidos	
Topic	
Programación orientada obxectos en Java	Linguaxe Java. Clases, obxectos e referencias. Tipos de datos, instrucións, operadores. Matrices e coleccións. Herdanza, interfaces, polimorfismo. Tratamento de excepcións. Programación de gráficos mediante JavaFX.
Creación de aplicacións para dispositivos móbiles	Sistemas Android. Ferramentas de desenvolvemento de aplicacións. Interfaces de usuario para dispositivos móbiles. Acceso a bases de datos. Manexo de sensores e cámara. Procesado de imaxe. Comunicación inalámbrica con dispositivos industriais. Acceso a bases de datos.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	18	9	27
Resolución de problemas	20	40	60
Lección maxistral	12.5	25	37.5
Informe de prácticas, prácticum e prácticas externas	8.5	17	25.5
*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	Desenvolvemento de aplicacións industriais para control, monitorización e automatización de plantas industriais, en sistemas Windows e Android
Resolución de problemas	Posta en práctica dos coñecementos adquiridos na materia mediante a súa aplicación á resolución de problemas habituais na enxeñaría
Lección maxistral	Introdución e descrición dos diferentes conceptos e técnicas relacionados coa materia

Atención personalizada	
Methodologies	**Description**
Lección maxistral	Atención personalizada ás dúbidas do alumnado
Prácticas de laboratorio	Atención personalizada ás dúbidas do alumnado
Resolución de problemas	Atención personalizada ás dúbidas do alumnado
Tests	**Description**
Informe de prácticas, prácticum e prácticas externas	Atención personalizada ás dúbidas do alumnado

Avaliación					
	Description	Qualification	Evaluated Competencess		
Prácticas de laboratorio	Avaliarase as solucións achegadas polo alumno na resolución das diferentes prácticas de laboratorio propostas	40	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Resolución de problemas	Cualificarase a aplicación dos coñecementos adquiridos na resolución de tarefas de enxeñería específicas	30	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Lección maxistral	Avaliarase a participación activa do alumno nas diferentes actividades formativas	10	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17
Informe de prácticas, prácticum e prácticas externas	Calidade dos informes das diferentes prácticas propostas e das solucións achegadas	20	CG3 CG4	CE3	CT2 CT5 CT6 CT7 CT17

Other comments on the Evaluation

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considérase que o

alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0.0).

A avaliación nesta materia ten un compoñente moi alto de avaliación continua durante a realización das diferentes actividades académicas desenvolvidas durante o curso. No caso de convocatorias diferentes da convocatoria de maio, a avaliación realizarase no laboratorio, mediante o desenvolvemento práctico dunha aplicación similar ás desenvolvidas durante o curso.

Bibliografía. Fontes de información

Basic Bibliography

B.C. Zapata, **Android Studio application development**, 2013,

K. Sharan, **Beginning Java 8 fundamentals**, 2014,

I.F. Darwin, **Java cookbook**, 2014,

L.M. Lee, **Android application development coockbook**, 2013,

Complementary Bibliography

N. Smyth, **Android Studio Development Essentials**, http://www.techotopia.com/index.php/Android_Studio_Development_Essentials,

N. Smyth, **Android 4 app development essentials**, http://www.techotopia.com/index.php/Android_4_App_Development_Essentials,

G. Allen, **Beginning Android 4**, 2012,

M. Aydin, **Android 4: new features for application development**, 2012,

J. Bryant, **Java 7 for absolute beginners**, 2012,

M. Burton, D. Felke, **Android application development for dummies**, 2012,

J. Friesen, **Learn Java for Android development**, 2013,

M.T. Goodrich, R. Tamassia, M.H. Goldwasser, **Data structures & algorithms in Java**, 2014,

J. Graba, **An introduction to network programming with Java**, 3rd edition, 2013,

I. Horton, **Beginnning Java 7 Edition**, 2011,

J. Howse, **Android application programming with OpenCV**, 2013,

W. Jackson, **Android Apps for absolute beginners**, 2012,

L. Jordan, P. Greyling, **Practical Android Projects**, 2011,

Y.D. Liang, **Introduction to Java programming**, 2011,

R. Matthews, **Beginning Android tablet programming**, 2011,

P. Mehta, **Learn OpenGL ES**, 2013,

G. Milette, A. Stroud, **Professional Android sensor programming**, 2012,

J. Morris, **Android user interface development**, 2011,

R. Schwartz, etc, **The Android developer's cookbook**, 2013,

R.G. Urma, M. Fusco, A. Mycroft, **Java 8 in action**, 2015,

Recomendacións

Subjects that it is recommended to have taken before

Informática: Informática para a enxeñaría/V12G320V01203

Plan de Continxencias

Description

Os contidos e os resultados de aprendizaxe non deberán ser modificados para poder garantir o recollido nas memorias da titulación. Debe tratarse de axustar os materiais, titorías e as metodoloxías docentes para tratar de acadar estes resultados. Trátase dun aspecto de grande importancia para a superación dos procesos de acreditación a que están sometidas as diferentes titulacións. E dicir, o plan de continxencia debe basearse nun desenvolvemento da materia, adaptando as metodoloxías e os materiais, na procura do cumprimento dos resultados de aprendizaxe de todo o alumnado.

As metodoloxías docentes se impartirán, de ser necesario, adecuándoas ós medios telemáticos que se poñan a disposición do profesorado, ademais da documentación facilitada a través de FAITIC e outras plataformas, correo electrónico, etc.

Cando non sexa posible a docencia presencial, na medida do posible, 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, intentado manter a presencialidade para as prácticas experimentais de laboratorio, sempre que os grupos cumpran coa normativa establecida no momento polas autoridades pertinentes en materia sanitaria e de seguridade. No caso de non poder ser impartida de forma presencial, aqueles contidos non virtualizables se impartirán ou suplirán por outros (traballo autónomo guiado, etc.) que permitan

acadar igualmente as competencias asociados a eles. As titorías poderán desenvolverse indistintamente de forma presencial (sempre que sexa posible garantir as medidas sanitarias) ou telemáticas (e-mail e outros) respectando ou adaptando os horarios de titorías previstos. Asemade, farase unha adecuación metodolóxica ó alumnado de risco, facilitándolle información específica adicional, de acreditarse que non pode ter acceso ós contidos impartidos de forma convencional.

Información adicional sobre a avaliación: manteranse aquelas probas que xa se veñen realizando de forma telemática e, na medida do posible, manteranse as probas presenciais adecuándoas á normativa sanitaria vixente. As probas se desenvolverán 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 outros (entregas de traballo autónomo guiado, etc.)

IDENTIFYING DATA				
Seguridade e hixiene industrial				
Subject	Seguridade e hixiene industrial			
Code	V12G360V01907			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	González de Prado, Begoña			
Lecturers	Díez Sarabia, Aida María González de Prado, Begoña			
E-mail	bgp@uvigo.es			
Web				
General description	Nesta materia abórdanse os aspectos máis destacados das técnicas xerais e específicas da Seguridade do Traballo, as diferentes ramas da Hixiene do Traballo, a Ergonomía como disciplina centrada no sistema persoa-máquina, a influencia dos factores psicosociais sobre a saúde do traballador, así como a lexislación elaborada sobre todos estes aspectos.			

Competencias	
Code	
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CG6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
CG7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
CG11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
CT2	CT2 Resolución de problemas.
CT5	CT5 Xestión da información.
CT7	CT7 Capacidade de organizar e planificar.
CT8	CT8 Toma de decisións.
CT9	CT9 Aplicar coñecementos.
CT10	CT10 Aprendizaxe e traballo autónomos.
CT14	CT14 Creatividade.
CT17	CT17 Traballo en equipo.
CT20	CT20 Capacidade para comunicarse con persoas non expertas na materia.

Resultados de aprendizaxe		
Learning outcomes		Competences
CG1 Capacidade para a redacción, firma e desenvolvemento de proxectos no ámbito da enxeñaría industrial, que teñan por obxecto, segundo a especialidade, a construción, reforma, reparación, conservación, demolición, fabricación, instalación, montaxe ou explotación de: estruturas, equipos mecánicos, instalacións enerxéticas, instalacións eléctricas e electrónicas, instalacións e plantas industriais, e procesos de fabricación e automatización.	CG6 CG11	CT5
CG2 Capacidade para a dirección das actividades obxecto dos proxectos de enxeñaría descritos na competencia CG1.	CG11	CT5 CT9 CT10
CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.	CG4 CG7	CT2 CT5 CT9 CT10 CT14 CT17 CT20
CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Industrial.	CG4 CG6 CG7 CG11	CT2 CT7 CT8 CT9 CT10 CT14 CT17 CT20

CT1 Análise e síntese.	CG4 CG7	CT2 CT5 CT7 CT8 CT9 CT14 CT17 CT20

Contidos	
Topic	
TEMA 1.- Introdución á Seguridade e Hixiene do Traballo	1.1.- Terminoloxía básica 1.2.- Saúde e traballo 1.3.- Factores de risco 1.4.- Incidencia dos factores de risco sobre a saúde 1.5.- Técnicas de actuación fronte aos danos derivados do traballo
TEMA 2.- Evolución histórica e lexislación	2.1.- Evolución histórica 2.2.- Evolución en España 2.3.- A Seguridade e Hixiene do Traballo na lexislación española 2.4.- Responsabilidades e sancións
TEMA 3.- Seguridade do Traballo	3.1.- O accidente de traballo 3.2.- Seguridade do traballo 3.3.- Causas dos accidentes 3.4.- Análise estatística dos accidentes 3.5.- Xustificación da prevención
TEMA 4.- Técnicas de seguridade. Avaliación de riscos	4.1.- Técnicas de seguridade 4.2.- Obxectivos da avaliación de riscos 4.3.- Avaliación xeral 4.4.- Avaliación das condicións de traballo 4.5.- Técnicas analíticas posteriores ao accidente 4.6.- Técnicas analíticas anteriores ao accidente
TEMA 5.- Normalización	5.1.- Vantaxes, requisitos e características das normas 5.2.- Normas de seguridade 5.3.- Procedemento de elaboración 5.4.- Orde e limpeza
TEMA 6.- Sinalización de seguridade	6.1.- Características e normativa 6.2.- Clases de sinalización 6.3.- Sinalización en forma de panel
TEMA 7.- Equipos de protección	7.1.- Individual 7.2.- Integral 7.3.- Colectiva
TEMA 8.- Técnicas específicas de seguridade	8.1.- Máquinas 8.2.- Incendios e explosións 8.3.- Contactos eléctricos 8.4.- Manutención manual e mecánica 8.5.- Industria mecánica 8.6.- Produtos químicos 8.7.- Mantemento
TEMA 9.- Hixiene do Traballo	9.1.- Ambiente industrial 9.2.- Hixiene do traballo e terminoloxía 9.3.- Hixiene teórica e valores límites ambientais 9.4.- Hixiene analítica 9.5.- Hixiene de campo e enquisa hixiénica 9.6.- Hixiene operativa
TEMA 10.- Axentes físicos ambientais	10.1.- Ruído e vibracións 10.2.- Iluminación 10.3.- Radiacións *ionizantes e non *ionizantes 10.4.- Tensión térmica
TEMA 11.- Protección fronte a riscos hixiénicos	11.1.- Vías respiratorias 11.2.- Oídos 11.3.- Ollos
TEMA 12.- Riscos hixiénicos da industria química	12.1.- Procesos inorgánicos 12.2.- Procesos orgánicos 12.3.- Accidentes graves
TEMA 13.- Seguridade nos lugares de traballo	13.1.- A seguridade no proxecto 13.2.- Mapas de riscos

TEMA 14.- Ergonomía	14.1.- Concepto 14.2.- Aplicación da ergonomía á seguridade 14.3.- Carga física e fatiga muscular 14.4.- Carga e fatiga mental
TEMA 15.- Psicosocioloxía aplicada á prevención	15.1.- Factores psicosociais 15.2.- Consecuencias dos factores psicosociais sobre a saúde 15.3.- Avaliación dos factores psicosociais 15.4.- Intervención psicosocial

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	26	49	75
Resolución de problemas	24	22	46
Exame de preguntas obxectivas	4	25	29

*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 oral e directa, por parte do profesor, dos coñecementos fundamentais correspondentes aos temas da materia.
Resolución de problemas	O profesor expón aos alumnos unha serie de problemas para que os traballen e resolvan en clase en pequenos grupos.

Atención personalizada

Methodologies	Description
Resolución de problemas	Darase a coñecer os alumnos, a principio de curso, os horarios de tutorías nos que se resolverán as duvidas que existan con respecto á teoría, problemas e traballos

Avaliación

	Description	Qualification	Evaluated Competencess	
Resolución de problemas	Proporase ao alumno unha seria de problemas que terá que resolver	40	CG4 CG6 CG7	CT2 CT5 CT8 CT9 CT10 CT14 CT17
Exame de preguntas obxectivas	A finalidade desta proba de resposta múltiple, que figura no calendario de exames da Escola, é avaliar o nivel de coñecementos alcanzado polos alumnos	60	CG11	CT5 CT7 CT8 CT9 CT10

Other comments on the Evaluation

Con respecto ao exame de XULLO (2ª convocatoria), se manterá a cualificación obtida polo alumno nos controis e presentacións / exposicións realizados durante o período docente. Iso significa que o alumno unicamente realizará próbaa tipo test&*nbsp; do devandito exame.&*nbsp; Cando a Escola libere a un alumno do proceso de avaliación continua, a súa cualificación será o 100% da nota obtida en próbaa tipo test anteriormente citada.Compromiso éticoEspérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, por exemplo), considerarase que *elalumno non reúne os requisitos necesarios para superar a materia.

Bibliografía. Fontes de información

Basic Bibliography

Mateo Floría, P. y otros, **Manual para el Técnico en Prevención de Riesgos Laborales**, 9ª,

Cortés Díaz, J. Mª, **Técnicas de Prevención de Riesgos Laborales: Seguridad e Higiene del Trabajo**, 9ª,

Complementary Bibliography

Menéndez Díez, F. y otros, **Formación Superior en Prevención de Riesgos Laborales**, 4ª,

Gómez Etxebarría, G., **Prontuario de Prevención de Riesgos Laborales**,

Recomendacións

Other comments

Para matricularse nesta materia é necesario superar ou ben matricularse de todas as materias dos cursos inferiores ao curso en que está situada esta materia.

En caso de discrepancias, prevalecerá a versión en castelán desta guía.

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- Todas

* Metodoloxías docentes que se modifican- Ninguna.
As metodoloxías docentes se impartirán, de ser necesario, adecuándoas ós medios telemáticos que se poñan a disposición do profesorado, ademais da documentación facilitada a través de FAITIC e outras plataformas, correo electrónico, etc.

* Mecanismo non presencial de atención ao alumnado (titorías)- As titorias desenvolveranse de forma telemática. Asemade, farase unha adecuación
metodolóxica ó alumnado de risco, facilitándolle información específica adicional, de acreditarse que non pode ter acceso ós contidos impartidos de forma convencional

* Modificacións (se proceder) dos contidos a impartir- nInguno

* Bibliografía adicional para facilitar a auto-aprendizaxe- ninguna

* Outras modificacións

=== ADAPTACIÓN DA AVALIACIÓN ===

* Probas xa realizadas- se mantienen con el mismo peso

Proba XX: [Peso anterior 00%] [Peso Proposto 00%]
...

* Probas pendentes que se manteñen:
Proba XX: [Peso anterior 00%] [Peso Proposto 00%]

Mantéñense os criterios de avaliación adecuando a realización das probas, no caso de ser necesario e por indicación en Resolución Reitoral, ós medios telemáticos postos a disposición do profesorado

* Probas que se modifican- ninguna
[Proba anterior] => [Proba nova]

* Novas probas- ninguna

* Información adicional: As probas se desenvolverán 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.

IDENTIFYING DATA				
Laser technology				
Subject	Laser technology			
Code	V12G360V01908			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish English			
Department				
Coordinator	Pou Saracho, Juan María			
Lecturers	Pou Saracho, Juan María			
E-mail	jpou@uvigo.es			
Web				
General description	(*)Introduction to laser technology and its applications for undergraduate students of the industrial field.			

Competencies	
Code	
CG10	CG10 Ability to work in a multidisciplinary and multilingual environment.
CT10	CT10 Self learning and work.

Learning outcomes		
Learning outcomes	Competences	
- Know the physical principles in which it bases the operation of a laser and his parts. - Know the main properties of a laser and relate them with the potential applications. - Know the different types of lasers differentiating his specific characteristics. - Know the main applications of the technology laser in the industry.	CG10	CT10

Contents	
Topic	
Chapter 1.- INTRODUCTION	1. Electromagnetic waves in the vacuum and in the matter. 2. Laser radiation. 3. Properties of the laser radiation.
Chapter 2.- BASICS	1. Photons and energy level diagrams. 2. Spontaneous emission of electromagnetic radiation. 3. Population inversion. 4. Stimulated emission. 5. Amplification.
Chapter 3. COMPONENTS OF A LASER	1. Active medium 2. Excitation mechanisms. 3. Feedback mechanisms. 4. Optical cavity. 5. Exit device.
Chapter 4. TYPES OF LASER	1. Gas lasers 2. Solid-state lasers 3. Diode lasers. 4. Other lasers.
Chapter 5. OPTICAL COMPONENTS AND SYSTEMS	1. Spherical lenses. 2. optical centre of a lens. 3. Thin lenses. Ray tracing. 4. Thin lenses coupling. 5. Mirrors. 6. Filters. 7. OPtical fibers.
Chapter 6. INDUSTRIAL APPLICATIONS	1. Introduction to laser materials processing 2. Introduction to laser cutting and drilling. 3. Introduction to laser welding. 4. Introduction to laser marking. 5. Introduction to laser surface treatments.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	30.6	48.6
Lecturing	32.5	65	97.5
Essay questions exam	1.7	0	1.7
Report of practices, practicum and external practices	1.9	0	1.9
Problem and/or exercise solving	0.3	0	0.3

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

Methodologies

	Description
Laboratory practical	Activities of application of the knowledge to specific situations and of acquisition of basic and practical skills related to the matter object of study. They will be developped in the laboratories of industrial applications of the lasers of the EEI.
Lecturing	Exhibition on the part of the teacher of the contents on the matter object of study. Exhibition of real cases of application of the laser technology in the industry.

Personalized assistance

Methodologies	Description
Laboratory practical	

Assessment

	Description	Qualification	Evaluated Competencess	
Essay questions exam	The examination will consist of five questions of equal value. Four of them will correspond to the contents of theory and the fifth one to the contents seen in the laboratory practices.	70	CG10	CT10
Report of practices, practicum and external practices	The evaluation of the laboratory practices will be carried out by means of the qualification of the corresponding practice reports.	20	CG10	CT10
Problem and/or exercise solving	During the course there will be carried out a test of follow-up of the subject that will consist of two questions of equal value.	10	CG10	CT10

Other comments on the Evaluation

If some student was resigning officially the continuous assessment that is carried out by means of the test of follow-up of the subject, the final note would be calculated by the following formula: (0.8 x Exam qualification) + (0.2 x Practices qualification). It is mandatory to carry out the laboratory parctices in order to pass the subject. It is mandatory to attend 75% of the theory lessons to pass the subject.

Ethical commitment: it is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

Sources of information

Basic Bibliography

Jeff Hecht, **UNDERSTANDING LASERS: AN ENTRY-LEVEL GUIDE**, IEEE, 2008

W.Steen, J. Mazumder, **LASER MATERIALS PROCESSING**, Springer, 2010

Complementary Bibliography

Recommendations

Other comments

Requirements: To register for this module the student must have passed or be registered for all the modules of the previous year.

In case of discrepancies, the spanish version (castellano) will prevail.

Contingency plan

Description

The contents and the results of learning will not owe to be modified for power guarantee the collected in the memories of the qualifications. It owes to treated to adjust the materials, tutorships and the teaching methodologies to treat to achieve these results. It treats of an aspect of big importance stop the overrun of the processes of the one who are subjected the different qualifications. And say, the plan of contingency owes to based in a development of the subject, adapting the methodologies and the materials, in the research of the fulfilment of the resulted of learning of all the students.

The teaching methodologies will impart , to be necessary, to the telematic means that put the disposal of the teaching staff, in addition to the documentation facilitated through FAITIC and other platforms, email, etc.

When it was not possible to presential sesions, in the measure of the possible, will prevail the contained theorists by telematic means as well as those contents of practices of resolution of problems, classroom of computing, and others, that can be virtuals or developed pole students of way guided, tried keep the presential stop the experimental practices of laboratory, always that the groups fulfil with the rule established in the moment by the authorities in sanitary subject and of security. In the case of no power be imparted of form presential, those contents no virtuals will impart or by others (autonomous work guided, etc.) Enabling achieve equally the competitions associated it they. The titorships will be able to developed indistinctly of form presential (always that it was possible to guarantee the sanitary measures) or telematic (and email and others) respecting or adapting the schedules of titorships due. it will do a adecuation methodological to the students of risk, facilitating him additional specific information, to accredit that can not have access to the contained imparted of conventional form.

Additional information envelope to evaluation: they will keep those proofs that already come realizing of telematic form and, in the measure of the possible, will keep the proofs presentials to the normative valid medic. The proofs will develop of form presential except Resolution Reitoral that indicate that they owe do of form non-presential, realizing gave way through the distinct tools put the disposal of the teaching staff. Those proofs no-don of telematic form by others (deliveries of autonomous work guided, etc.)

IDENTIFYING DATA				
Internships: Internships in companies				
Subject	Internships: Internships in companies			
Code	V12G360V01981			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Izquierdo Belmonte, Pablo Eguizábal Gándara, Luis Eduardo			
Lecturers	Urgal González, Begoña			
E-mail	pabloizquierdob@uvigo.es eguizaba@uvigo.es			

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

IDENTIFYING DATA				
Traballo de Fin de Grao				
Subject	Traballo de Fin de Grao			
Code	V12G360V01991			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Enxeñaría dos materiais, mecánica aplicada e construción Tecnoloxía electrónica			
Coordinator	Izquierdo Belmonte, Pablo			
Lecturers	Collazo Fernández, Antonio Nogueiras Meléndez, Andres Augusto			
E-mail	pabloizquierdob@uvigo.es			
Web				
General description	O Traballo de Fin de Grao (TFG) é un traballo orixinal e persoal que cada estudante realizará de forma autónoma baixo tutorización docente, e debe permitirlle mostrar de forma integrada a adquisición dos contidos formativos e as competencias asociadas ao título. A súa definición e contidos están explicados de forma máis extensa no Regulamento do Traballo Fin de Grao aprobado pola Xunta de Escola da Escola de Enxeñería Industrial o 21 de xullo de 2015.			

Competencias	
Code	
CG1	CG1 Capacidade para deseñar, desenvolver, implantar, xestionar e mellorar produtos e procesos nos distintos ámbitos industriais, por medio de técnicas analíticas, computacionais ou experimentais apropiadas.
CG2	CG2 Capacidade para dirixir actividades relacionadas coa competencia CG1.
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CG10	CG10 Capacidade para traballar nun medio multilingüe e multidisciplinar.
CG12	CG12 Capacidade para a integración das competencias CG1 a CG11 nos traballos e proxectos relacionados coas Tecnoloxías Industriais.
CT4	CT4 Comunicación oral e escrita de coñecementos en lingua estranxeira.
CT12	CT12 Habilidades de investigación.
CT13	CT13 Capacidade para comunicarse por oral e por escrito en lingua galega.

Resultados de aprendizaxe		
Learning outcomes	Competences	
Procura, ordenación e estructuración de información sobre calquera tema.	CG1 CG2 CG3 CG4 CG10 CG12	CT12
Elaboración dunha memoria na que se recollan, entre outros, os seguintes aspectos: antecedentes, problemática ou estado da arte, obxectivos, fases do proxecto, desenvolvemento do proxecto, conclusións e liñas futuras.	CG1 CG2 CG3 CG4 CG10 CG12	CT4 CT12 CT13
Deseño de equipos, prototipos, programas de simulación, etc, segundo especificacións.	CG1 CG2 CG3 CG4 CG10 CG12	CT12
No momento de realizar a solicitude da defensa do TFG, o alumno deberá xustificar a adquisición dun nivel adecuado de competencia en lingua inglesa.		CT4

Contidos

Topic	
Proxectos clásicos de enxeñería	Poden versar, por exemplo, sobre o deseño e mesmo a fabricación dun prototipo, a enxeñaría dunha instalación de produción, ou a implantación dun sistema en calquera campo industrial. Polo xeral, neles desenvólvese sempre a parte documental da memoria (cos seus apartados de cálculos, especificacións, estudos de viabilidade, seguridade, etc. que se precisen en cada caso), planos, prego de condicións e orzamento e, nalgúns casos, tamén se contempla os estudos propios da fase de execución material do proxecto.
Estudos técnicos, organizativos e económicos	Consistentes na realización de estudos relativos a equipos, sistemas, servizos, etc., relacionados cos campos propios da titulación, que traten un ou máis aspectos relativos ao deseño, planificación, produción, xestión, explotación e calquera outro propio do campo da enxeñaría, relacionando cando cumpra alternativas técnicas con avaliacións económicas e discusión e valoración dos resultados.
Traballos teórico-experimentais	De natureza teórica, computacional ou experimental, que constitúan unha contribución á técnica nos diversos campos da enxeñaría incluíndo, cando cumpra, avaliación económica e discusión e valoración dos resultados.

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	5	25	30
Traballo tutelado	15	210	225
Presentación	1	14	15

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

Metodoloxía docente

	Description
Actividades introdutorias	O alumno realizará, de forma autónoma, unha procura bibliográfica, lectura, procesamento e elaboración de documentación.
Traballo tutelado	O estudante, de maneira individual, elabora unha memoria segundo as indicacións do Regulamento do Traballo Fin de Grao da EEI.
Presentación	O alumnado debe preparar e defender o traballo realizado diante dun tribunal de avaliación segundo as indicacións do Regulamento do Traballo Fin de Grao da EEI.

Atención personalizada

Methodologies	Description
Traballo tutelado	Cada alumno terá un titor e/ou un co-titor encargados de guiarlle, e que lle marcarán as directrices oportunas para realizar o TFG.

Avaliación

	Description	Qualification	Evaluated Competencess	
Traballo tutelado	A cualificación da memoria do Traballo Fin de Grao levará a cabo segundo o especificado no Regulamento do Traballo Fin de Grao da Escola de Enxeñería Industrial.	70	CG1 CG2 CG3 CG4 CG10 CG12	CT4 CT12 CT13
Presentación	A defensa do Traballo Fin de Grao levará a cabo segundo o especificado no Regulamento do Traballo Fin de Grao da Escola de Enxeñería Industrial.	30	CG1 CG2 CG3 CG4 CG10 CG12	CT4 CT12 CT13

Other comments on the Evaluation

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Recomendacións

Other comments

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio ou outros) considerarase que a cualificación global no presente curso académico será de suspenso (0.0).

Requisitos: Para matricularse no Traballo Fin de Grao é necesario superar ou ben estar matriculado de todas as materias dos cursos inferiores ao curso no que está situado o TFG.

Información importante: No momento da defensa do TFG, o alumno deberá ter todas as materias restantes do título superadas, tal como establece o artigo 7.7 do Regulamento para a realización do Traballo Fin de Grao da Universidade de Vigo.

A orixinalidade da memoria será obxecto de estudo mediante unha aplicación informática de detección de plaxios.

Plan de Continxencias

Description

As metodoloxías e as probas se realizarán, de ser necesario, adecuándoas ós medios telemáticos que se poñan a disposición do profesorado, ademais da documentación facilitada a través de FAITIC e outras plataformas, correo electrónico, etc. As exposicións poderán desenvolverse, se é preciso, por medios telemáticos realizándose dese xeito a través das distintas ferramentas postas a disposición do profesorado.

IDENTIFYING DATA				
Prácticas en empresa/asignatura optativa				
Subject	Prácticas en empresa/asignatura optativa			
Code	V12G360V01999			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Organización de empresas e márketing			
Coordinator	Izquierdo Belmonte, Pablo Eguizábal Gándara, Luis Eduardo			
Lecturers	Urgal González, Begoña			
E-mail	pabloizquierdob@uvigo.es eguizaba@uvigo.es			
Web	http://eei.uvigo.es			
General description	Mediante a realización de prácticas en empresa o alumno poderá aplicar os coñecementos e as competencias adquiridas durante os seus estudos, o que permitirá complementar e reforzar a súa formación e facilitar a súa incorporación ao mercado laboral.			

Competencias	
Code	
CG1	CG1 Capacidade para deseñar, desenvolver, implantar, xestionar e mellorar produtos e procesos nos distintos ámbitos industriais, por medio de técnicas analíticas, computacionais ou experimentais apropiadas.
CG2	CG2 Capacidade para dirixir actividades relacionadas coa competencia CG1.
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.

Resultados de aprendizaxe	
Learning outcomes	Competences
Capacidade para adaptarse ás situacións reais da profesión.	CG1 CG2 CG3 CG4
Integración en grupos de traballo multidisciplinares.	CG2 CG3 CG4
Responsabilidade e traballo autónomo.	CG1 CG2 CG3 CG4

Contidos	
Topic	
Integración nun grupo de traballo nunha empresa.	O alumno integrarase no contexto organizativo dunha empresa, téndose que coordinar cos diferentes membros do grupo de traballo ao que sexa asignado.
Realización de actividades ligadas ao desempeño da profesión.	Ao alumno encomendaráselle unha serie de tarefas relacionadas cos coñecementos e coas competencias dos seus estudos.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Prácticum, Practicas externas e clínicas	0	150	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	O alumno integrarase nun grupo de traballo nunha empresa onde terá a oportunidade de poñer en práctica os coñecementos e as competencias adquiridas durante os seus estudos, e así complementar e reforzar a súa formación.

Atención personalizada

Methodologies	Description
Prácticum, Practicas externas e clínicas	O alumno dispoñerá dun titor na empresa onde fará a súas prácticas e dun titor académico.

Avaliación

	Description	Qualification	Evaluated Competencess
Prácticum, Practicas externas e clínicas	Os estudantes en prácticas deberán manter un contacto continuado non só co seu titor na empresa, senon tamén co seu titor académico. Ao concluir 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 a valoración do desempeño do alumno realizada polo titor na empresa, o seguimento realizado polo titor académico e os informes entregados polo alumno.	100	CG1 CG2 CG3 CG4

Other comments on the Evaluation

Adicionalmente ao xa exposto nesta guía docente é preciso facer as seguintes aclaracións:
1º. Esta materia rexerase polo establecido no Regulamento de Prácticas en Empresa da EEI (http://eei.uvigo.es/opencms/export/sites/eei/eei_gl/documentos/escola/Normativa/practicas_empresa.pdf).
2º. A Escola fará pública a oferta de prácticas en empresa curriculares entre as que o alumnado, que cumpra os requisitos descritos no artigo 6 do citado regulamento, deberá facer a súa escolla dentro do prazo fixado ao efecto. O procedemento de realización de prácticas en empresa curriculares está establecido no artigo 7 do regulamento.
3º. A duración das prácticas pode chegar a ser ata de un máximo de 240 horas, para que o alumno saque o maior proveito da súa estadía na empresa. Será a empresa na súa oferta de prácticas a que estipulará a duración das mesmas.

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 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 ===
A metodoloxía docente adaptarase ás circunstancias, podéndose desenvolver as prácticas empregando a modalidade do teletraballo, de acordo á planificación que estableza a empresa que acolla ao alumno.

=== ADAPTACIÓN DA AVALIACIÓN ===
Non se producirán cambios na metodoloxía de avaliación.