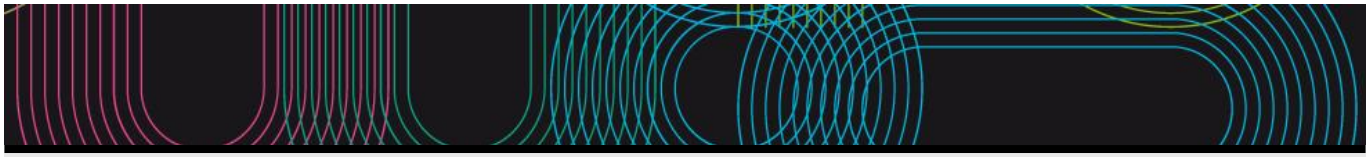

(*)Escola de Enxeñaría Industrial

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.
V12G363V01101	Graphic expression: Fundamentals of engineering graphics	1st	9
V12G363V01102	Physics: Physics 1	1st	6
V12G363V01103	Mathematics: Algebra and statistics	1st	9
V12G363V01104	Mathematics: Calculus 1	1st	6
V12G363V01201	Business: Introduction to business management	2nd	6
V12G363V01202	Physics: Physics 2	2nd	6
V12G363V01203	Computer science: Computing for engineering	2nd	6
V12G363V01204	Mathematics: Calculus 2 and differential equations	2nd	6
V12G363V01205	Chemistry: Chemistry	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V12G363V01301	Materials science and technology	1st	6
V12G363V01302	Basics of circuit analysis and electrical machines	1st	6
V12G363V01303	Mechanism and machine theory	1st	6
V12G363V01304	Automation and control fundamentals	1st	6
V12G363V01305	Basics of operations management	1st	6
V12G363V01401	Electronic technology	2nd	6
V12G363V01402	Fundamentals of manufacturing systems and technologies	2nd	6

V12G363V01403	Fluid mechanics	2nd	6
V12G363V01404	Mechanics of materials	2nd	6
V12G363V01405	Thermodynamics and heat transfer	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V12G363V01501	Applied electrotechnics	1st	6
V12G363V01502	Materials engineering	1st	6
V12G363V01503	Physics 3	1st	6
V12G363V01504	Hydraulic turbomachines	1st	6
V12G363V01505	Specialized mathematics	1st	6
V12G363V01602	Machine design and testing	2nd	6
V12G363V01603	Elasticity and additional topics in mechanics of materials	2nd	6
V12G363V01604	Manufacturing engineering	2nd	6
V12G363V01605	Electrical machines	2nd	6
V12G363V01606	Chemical technology	2nd	6

Year 4th

Code	Name	Quadmester	Total Cr.
V12G363V01701	Electronic instrumentation	1st	6
V12G363V01702	Technical Office	1st	6
V12G363V01703	Environmental technology	1st	6
V12G363V01704	Thermal technology	1st	6
V12G363V01705	Electrical systems	1st	6
V12G363V01801	Control and industrial automation	2nd	6
V12G363V01802	Basics of business administration	2nd	6
V12G363V01902	Electrical components in vehicles	2nd	6
V12G363V01903	Technical english 1	2nd	6
V12G363V01904	Technical english 2	2nd	6
V12G363V01905	Methodology for the preparation, presentation and management of technical projects	2nd	6
V12G363V01906	Advanced programming for engineering	2nd	6
V12G363V01907	Safety and industrial hygiene	2nd	6
V12G363V01908	Laser technology	2nd	6
V12G363V01981	Internships: Internships in companies	2nd	6
V12G363V01991	Final Year Dissertation	2nd	12
V12G363V01999	Internships/elective	2nd	6

IDENTIFYING DATA				
Graphic expression: Fundamentals of engineering graphics				
Subject	Graphic expression: Fundamentals of engineering graphics			
Code	V12G363V01101			
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 Fernández Álvarez, Antonio González Rodríguez, Elena López Saiz, Esteban Patiño Barbeito, Faustino Prado Cerqueira, María Teresa Troncoso Saracho, José Carlos			
E-mail	antfdez@uvigo.es tsaracho@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The main objective of this course is to train students in the use of the most commonly used geometric shapes and projections in engineering drawing. The subject of Engineering Graphics also aims to improve the student's spatial vision and to introduce him/her to the concept of standardisation. To achieve these objectives, we will use both manual and computer-based drawing methods.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Spatial vision and knowledge of techniques for graphical representation, both through traditional methods of metric geometry and descriptive geometry, and through computer-aided design applications.
CT2	CT2 Problem solving.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Application of knowledge.

Learning outcomes			
Learning outcomes	Competences		
□ Know, understand, and apply a body of knowledge on the fundamentals and normalisation of industrial engineering drawing, in its broadest concept, while at the same time fostering the development of the spatial skills.	CG3 CG4	CE5	CT6
□ Acquire the capacity for abstract reasoning and for the establishment of strategies and efficient procedures in the resolution of graphic problems within the context of engineering works and projects.	CG3 CG4	CE5	CT2
□ Use new technologies to develop graphic communication skills, including the creation and interpretation of engineering drawings which are compliant with the Technical Drawing Standards.	CG6	CE5	CT6 CT9
□ Adopt a positive attitude towards lifelong learning, being proactive, participative and with a spirit of self-improvement.	CG4		CT9

Contents
Topic

Block 0. Computer-aided drawing. Sketching and application of standards.	- Introduction to Computer-aided Drawing. - Working environment. Coordinate systems. - Drawing commands. Graphical entities. Drawing aids. Object snapping. - Modify tools. Visualization options. Inquiry commands. - Plotting scaled drawings. - Sketching and application of standards.
Block 1. 2D geometry.	- Review of fundamental geometry concepts. - Conics: definitions, focal and major circles, drawing a tangent to a conic curve. - Constructing tangencies through loci, expansion/contraction and inversive geometry. - Technical curves (roulettes): trochoids and involutes (evolvents).
Block 2. Projections.	- Introduction: Types of projection. Projective invariants. - Topographic projection: Representation of basic elements (points, lines, planes). Elementary constructions, intersections, parallelism and perpendicularity. Roof plans. Landform drawing. - Multiview projection: Representation of basic elements (points, lines, planes). Parallelism and perpendicularity, true length of a segment, true size of a planar figure, planar sections. - Pictorial representation: Axonometric projection (isometric, dimetric, trimetric). Oblique projection (cavalier and cabinet projection). - Central projection: one-point perspective, two-point perspective and three-point perspective. - Surfaces: Polyhedra. Curved surfaces (ruled surfaces and surfaces of revolution). Intersection between two surfaces.
Block 3. Standardisation.	- Technical Drawing: Generalities. The graphic language of engineering. Major fields of application (architectural, topographical and engineering). Different forms of technical drawings (sketch, diagram, assembly drawing, part drawing, etc.). - Introduction to standardisation: Benefi□ts of standardization. Specifications, regulations and technical standards. - Basic standards for Technical Drawing: Drawing sheets. Title blocks. Types of lines. Lettering. Scales. Folding of drawing sheets. - General principles of representation: Basic conventions for views. Standard arrangements of the 6 principal orthographic views (first-angle and third-angle methods). Views (auxiliary, partial, local, symmetric, enlarged features). Sectional views (cuts and sections) and variations (offset sections, aligned sections, sections revolved in the relevant view, removed sections, half sections, local cuts, auxiliary sections). General conventions for hatching. Conventional representation (repeated features, simplified intersections, runouts, initial outlines). - Dimensioning: Principles of dimensioning. Types of dimensioning. Types of dimensions. Elements of dimensioning (dimension line, nominal dimension value, terminator, etc.). Arrangement of dimensions (chain, parallel and running dimensioning). Dimensioning of common manufactured features (radii, diameters, spheres, chamfers, counterbores, countersinks, etc.). - Threads. Elements of a thread. Types of threads. Standard representation of threads. Threads in assembly. Thread specification. Simplified representation. - Working drawings: Assembly drawings (definition and types). General rules and conventions for assembly drawings. Parts list. Part drawings. Drawing numbering system. Examples. - Tolerancing: Types of tolerances (dimensional and geometrical). Specifying dimensional tolerances (linear and angular). ISO system of tolerances ISO (tolerance grades, fundamental deviations, symbols). Fits. Examples.

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 masterclass. The professor will give a presentation of each module. The students will be encouraged to take an active role in the lectures through questions, discussions and exercises.
Problem solving	Exercises and/or problems will be posed and solved individually or in groups.
Seminars	Carrying out activities to reinforce learning through the tutored group resolution of practical cases linked to the theoretical content of the subject.
Project based learning	Carrying out of activities that require active participation and collaboration among the students.

Personalized assistance	
Methodologies	**Description**
Seminars	

Assessment					
	Description	Qualification	Evaluated Competencess		
Essay questions exam	There will be a final exam that will cover all the contents of the course, both theoretical and practical, and may include multiple-choice questions, reasoning questions, problem solving and development of practical cases. A minimum grade of 4/10 is required to pass the course.	65	CG3 CG4	CE5	CT2 CT9
Laboratory practice	Throughout the course, in certain labs, students will be asked to work out exercises and problems. These assignments will be assessed according to criteria that will have been communicated to them beforehand.	35	CG4	CE5	CT2 CT6 CT9

Other comments on the Evaluation

A grade of 5/10 is required to pass the course. Students who did not achieve a pass mark can re-sit the final exam.

Honor code: Students are expected to observe academic integrity. If any type of unethical behaviour is detected (e.g. cheating, plagiarism, use of unauthorised electronic devices, etc.) the student will be considered as not meeting the requirements to pass the course and will be assigned a failing grade (0).

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

To be successful in this course, it is recommended to have a background in technical drawing, standardisation and computer-aided drafting at high school level.

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

IDENTIFYING DATA				
Physics: Physics 1				
Subject	Physics: Physics 1			
Code	V12G363V01102			
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	Blanco García, Jesús Boutinguiza Larosi, Mohamed Lusquiños Rodríguez, Fernando Paredes Galán, Ángel Pérez Rodríguez, Martín Ribas Pérez, Fernando Agustín Roson Porto, Gabriel Serra Rodríguez, Julia Asunción Soto Costas, Ramón Francisco Souto Torres, Carlos Alberto Trillo Yáñez, María Cristina Varela Benvenuto, Ramiro Alberto			
E-mail	flusqui@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Physics course for 1st year bachelor degrees			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.

Learning outcomes	Competences		
To understand the basic concepts of the general laws of mechanics, and fields and waves.	CG3	CE2	
To be familiar with the basic instrumentation to measure physical quantities.		CE2	
To know the basic techniques for the analysis and evaluation of experimental data.	CG3	CE2	CT9 CT10
To develop practical solutions to elementary technical engineering problems in the areas of mechanics and fields and waves.	CG3	CE2	CT2 CT9 CT10

Contents	
Topic	
1.- UNITS, PHYSICAL QUANTITIES 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.- KINEMATICS	2.1.- Position, speed and acceleration vectors. Average and instantaneous values. 2.2.- Angular speed and angular acceleration. Average and instantaneous values. 2.3.- Relation between linear kinematic magnitudes and angular magnitudes. 2.4.- Intrinsic components. 2.5.- Study of simple movements: linear motion in 1D, circular motion, projectile motion. 2.6.- Expression of kinematic magnitudes in cartesian and polar coordinates
3.- NEWTON'S LAWS OF MOTION	3.1.- Force and interactions. 3.2.- Newton's first law. Inertial and non-inertial reference systems. 3.3.- Newton's second law. 3.4.- Mass and weight. 3.5.- Newton's third law. 3.6.- Momentum. Mechanical impulse. Angular momentum. 3.7.- Contact forces.
4.- WORK AND KINETIC ENERGY	4.1.- Work done 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.- Force and potential energy. 4.8.- Principle of conservation of mechanical energy.
5.- KINEMATICS OF SYSTEM OF PARTICLES	5.1.- System of particles. 5.2.- Rigid body. 5.3.- Translation movement. 5.4.- Movement of rotation around a fixed axis. 5.5.- General movement. 5.6.- Instantaneus center of rotation. 5.7.- Rolling motion. 5.8.- Relative movement.
6.- DYNAMICS OF SYSTEMS OF PARTICLES	6.1.- Systems of particles. Internal and external forces. 6.2.- Centre of mass. Movement of the centre of mass. 6.3.- Equations of the movement of a system of particles. 6.4.- Linear momentum. Conservation of linear momentum. 6.5.- Angular moment of a system of particles. Conservation of angular momentum. 6.6.- Work and power. 6.7.- Potential energy and kinetics of a system of particles. 6.8.- Conservation of energy of a system of particles. 6.9.- Collisions.
7.- RIGID BODY DYNAMICS	7.1.- Rotation of a rigid body 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 a rigid body. 7.7.- Kinetic energy in the general movement of a rigid body. 7.8.-Work in the general movement of a rigid body. 7.9.- Angular momentum of a rigid body. Conservation theorem.
8.- STATICS	8.1.- Equilibrium of rigid bodies. 8.2.- Center of gravity. 8.3.- Stability. 8.4.- Degrees of freedom and links
9.- PERIODIC MOTION	9.1.- Description of the oscillation. 9.2.- Simple harmonic motion. 9.3.- Energy in the simple harmonic motion. 9.4.- Applications of simple harmonic motion. 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 fluidostatics. 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 Fittings. 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 no structured activities (open practice) from the theoretical contents of the practices enumerated above. The groups of students shall resolve a practical problem proposed by the professor, selecting the theoretical frame and experimental tools to obtain the solution; for this, they will have basic information and the 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	Explanation by the professor of the contents of the subject, theoretical bases and/or guidelines of a work, exercise or project to be developed by the student.
Problem solving	Problems and/or exercises related to the subject are formulated. The student has to arrive to the correct solution by application of routines, formulas or algorithms, procedures of transformation of the available information and the interpretation of the results. It is usually employed ato complement the lectures.
Laboratory practical	Activities to apply the knowledge to specific situations and to acquire basic skills and procedures related with the subject. They are developed in special spaces 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 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 cannot follow the continuous assessment and who have asked and obtained the EC waiving 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.

IDENTIFYING DATA				
Mathematics: Algebra and statistics				
Subject	Mathematics: Algebra and statistics			
Code	V12G363V01103			
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	Matías Fernández, José María Castejón Lafuente, Alberto Elias			
Lecturers	Bazarra García, Noelia Castejón Lafuente, Alberto Elias Godoy Malvar, Eduardo Gómez Rúa, María Luaces Pazos, Ricardo Martín Méndez, Alberto Lucio Matías Fernández, José María Meniño Cotón, Carlos Rodal Vila, Jaime Alberto Rodríguez Campos, María Celia Sestelo Pérez, Marta			
E-mail	jmmatias@uvigo.es acaste@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Application of knowledge.

Learning outcomes				
Learning outcomes	Competences			
Acquire the basic knowledge on matrices, vector spaces and linear maps.	CB2	CG1 CG2 CG3	CE1 CE20 CE22	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	CB4	CG1 CG2 CG3	CE1 CE22	CT2 CT5 CT8

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.		CG2 CG3 CG9 CG14 CG15	CE1 CE1 CE2 CE3 CE4	CT1 CT2 CT2 CT3 CT4 CT5 CT6 CT9
Perform basic exploratory analysis of databases.		CG1 CG2 CG3 CG9 CG10 CG11 CG12 CG13 CG14	CE1 CE1 CE5 CE6 CE7 CE9 CE10 CE13 CE14 CE15 CE16	CT1 CT2 CT3 CT4 CT5 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.	CB2 CB3	CG3 CG3 CG4	CE1 CE7 CE13 CE14 CE16 CE17 CE18	CT1 CT2 CT3 CT4 CT6 CT10

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	36	24	60
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.
Autonomous problem solving	Student will have to solve problems and exercises by their own.

Personalized assistance	
Methodologies	**Description**
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

IDENTIFYING DATA				
Mathematics: Calculus 1				
Subject	Mathematics: Calculus 1			
Code	V12G363V01104			
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	Martínez Martínez, Antonio			
Lecturers	Bajo Palacio, Ignacio Busto Ulloa, Saray Díaz de Bustamante, Jaime Estévez Martínez, Emilio 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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
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.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problem solving.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Application of knowledge.
CT14	CT14 Creativity.
CT16	CT16 Critical thinking.

Learning outcomes			
Learning outcomes	Competences		
Understanding of the basic knowledges of differential calculation of one and of several variables.	CG3	CE1	CT1
Understanding of the basic knowledges of integral calculation of functions of a variable.	CG3	CE1	CT1
I handle of the technicians of differential calculation for the location of extremes, the local approximation of functions and the numerical resolution of systems of equations.	CG3 CG3 CG4	CE1 CE2	CT2 CT2 CT9 CT10 CT14 CT16
I handle of the technicians of integral calculation for the calculation of areas, volumes and surfaces.	CG3 CG3 CG4	CE1 CE1	CT1 CT1 CT2 CT9 CT14 CT16

Utilisation of computer tools to resolve problems of differential calculation and of integral calculation.	CG3 CG4	CE1 CE1	CT2 CT2 CT6 CT9 CT16

Contents

Topic	
Convergence and continuity	Introduction to real numbers. Absolute value. Euclidean space R^n. Successions. Series. Limits and continuity of functions of one and several variables.
Differential calculus of functions of one and several variables	Differential calculus of real functions of one real variable Differential calculus of functions of several real variables
Integral calculus of functions of one variable	The Riemann integral. Calculus of primitives. Improper integrals. Applications of the integral.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	20.5	30	50.5
Laboratory practical	12.5	5	17.5
Lecturing	32	39	71
Problem and/or exercise solving	3	3	6
Essay questions exam	2	3	5

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

Methodologies

	Description
Problem solving	The professor will resolve problems and exercises type and the student will have to resolve similar exercises.
Laboratory practical	They will employ computer tools to resolve exercises and apply the knowledges obtained in the classes of theory.
Lecturing	The professor will expose in the theoretical classes the contents gives the matter.

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Problem and/or exercise solving	They will make proofs written and/or works.	40	CG3 CG4	CE1	CT1 CT2 CT6 CT9 CT14 CT16
Essay questions exam	It will do a final examination on the contents of the whole of the matter.	60	CG3 CG4	CE1	CT1 CT2 CT9

Other comments on the Evaluation

The continuous eval. carry to cape on the previously exposed criteria. Those students that do not receive to the continuous eval be evaluated with a final examination on the contents of the whole of the matter, that will be the 100% of the note.

The continuous eval. of the students in second announcement consist in an examination on the contents of the whole of the matter, that will be 100% of the note.

Commitment:

"It expects that the present student a behaviour ethtic o suitable. In case to detect a behaviour no-ethic o (copy, plagiarism,

use of electronical devices unauthorised, and others) consider hat the student doesnt the necessary requirements to surpass the matter. In this case the calification in the present course will be of suspense (0.0)."

Sources of information
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

Recommendations
Subjects that continue the syllabus
Mathematics: Calculus 2 and differential equations/V12G330V01204
Subjects that are recommended to be taken simultaneously
Mathematics: Algebra and statistics/V12G330V01103

IDENTIFYING DATA				
Business: Introduction to business management				
Subject	Business: Introduction to business management			
Code	V12G363V01201			
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.			

Skills	
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 Problem solving.
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

IDENTIFYING DATA				
Physics: Physics 2				
Subject	Physics: Physics 2			
Code	V12G363V01202			
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 Cabaleiro Álvarez, David Fernández Fernández, José Luís Hermida Merino, Daniel López Vázquez, José Carlos Lugo Latas, Luis Lusquiños Rodríguez, Fernando Paredes Galán, Ángel Pérez Rodríguez, Martín Quintero Martínez, Félix Ribas Pérez, Fernando Agustín Sánchez Carnero, Noela Belén Soto Costas, Ramón Francisco Varela Benvenuto, Ramiro Alberto			
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			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
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.

IDENTIFYING DATA				
Computer science: Computing for engineering				
Subject	Computer science: Computing for engineering			
Code	V12G363V01203			
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	Rodríguez Damian, María Sáez López, Juan			
Lecturers	Ibáñez Paz, Regina Manzanedo García, Antonio Pérez Cota, Manuel Rodríguez Damian, Amparo Rodríguez Damian, María Rodríguez Diéguez, Amador Sáez López, Juan Vázquez Núñez, Fernando Antonio			
E-mail	mrdamian@uvigo.es juansaez@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			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Problem solving.
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			
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	
Concepts and basic technicians of programming applied to the engineering	Paradigms of programming Programming structured Programming languages Python features
Foundations of Python	Types of variables data and operators Comments Functions and standard Modules. Import and use of modules. Input-Output and control of errors
Structures of control	Decision if-else Iterative: while Boolean algebra
Sequences and iterative	Working with sequences: lists, tuples and string Types of data mutable and no mutable Concepts of reference and value Indexes of the sequences Cycle for- in Operators and sequences Functions and methods of sequences
Lists and List of lists	Operators and methods Characteristics of the lists Working with lists Indexes and iterate lists
Functions and own Modules	Definition and creation of functions Types of parameters and return values Concepts of value and reference in the parameters Scope of the variables Creation and invocation of modules
Persistence	Files, definitions and characteristics Basic operations with the files
Graphic interface	Creation of windows and widgets Manipulation of graphic elements Utilisation of variable control
Basic concepts of Computing	Computer Architecture Components: hardware, software Operating systems Databases

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Practices through ICT	22	24	46
Problem solving	11	18	29
Previous studies	1	5	6
Autonomous problem solving	6	20	26
Lecturing	10	0	10
Objective questions exam	4	7	11
Problem and/or exercise solving	8	12	20
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	Activities directed to take contact, gather information on the students, creation of groups, tasks of organisation, as well as present the subject.

Practices through ICT	Activities of application of the knowledges to concrete situations and of acquisition of basic skills and process related with the matter object of study. They develop in special spaces with equipment facilitated by the School, and expects that each student have his own laptop or the facilitated by the School.
Problem solving	Analysis of a fact, problem or real event with the purpose to know it, interpret it, resolve it, generate hypothesis, contrast data, complete knowledges, diagnose it and train in alternative procedures of solution.
Previous studies	Reading and understanding by part of the student of some subjects or parts of subjects to deepen in the knowledge of the same in class.
Autonomous problem solving	Resolution by part of the student of the different type of problems posed, being able to identify the efficiency of each method of resolution proposed.
Lecturing	Exhibition by part of the professor of the contents on the matter object of study, theoretical bases and/or guidelines of a work, exercise or project to develop by the student.

Personalized assistance

Methodologies	Description
Problem solving	They will resolve the doubts posed by the students. Teachers' tutoring in the agreed format.
Practices through ICT	Attention in the laboratory to the doubts that present or will indicate him the way to be followed so that the person find the solution. Teachers' tutoring in the schedule and format stipulated.

Assessment

	Description	Qualification	Evaluated Competencess		
Practices through ICT	Group of proofs that include the solution of problems, exercises of practical type, and activities to resolve.	70	CG3	CE3	CT5
Objective questions exam	Proofs for the evaluation of the competitions purchased that include questions with different alternative of answer (true/false, multiple election, ...)	15			
Problem and/or exercise solving	Resolution of practical exercises	15			

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 be considered 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 addition to 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.

CONTINUOUS ASSESSMENT 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 grade will be 4:

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

A student is considered passed if he/she obtains a five or more in compliance with all the 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 3-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, 3rd Edition: A Hands-On, Project-Based Introduction to Programming**, 3, No Starch Press, 2022

Silvia Guardati Buemo y Osvaldo Cairó Battistutti, **De cero al infinito. Aprende a programar en Python**, Cairó, 2020

Juan Diego Pérez Villa, **Introducción a la informática. Guía visual**, Anaya Multimedia, 2022

Complementary Bibliography

Jane Holcombe y Charles Holcombe, **ISE Survey of Operating Systems**, 7, McGraw Hill, 2022

Antonio Postigo Palacios, **Bases de datos**, Ediciones Paraninfo, 2021

Recommendations

IDENTIFYING DATA				
Matemáticas: Cálculo II e ecuacións diferenciais				
Subject	Matemáticas: Cálculo II e ecuacións diferenciais			
Code	V12G363V01204			
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 Busto Ulloa, Saray Cachafeiro López, María Alicia Calvo Ruibal, Natividad Castejón Lafuente, Alberto Elias Durany Castrillo, José Estévez Martínez, Emilio Fernández García, José Ramón Godoy Malvar, Eduardo Martínez Brey, Eduardo Martínez Torres, Javier Prieto Gómez, Cristina Magdalena			
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 na lingua propia.
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.

IDENTIFYING DATA				
Chemistry: Chemistry				
Subject	Chemistry: Chemistry			
Code	V12G363V01205			
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 Gómez Costas, Elena Gómez Graña, Sergio Lorenzo Fernández, Paula Moldes Moreira, Diego Nóvoa Rodríguez, Ramón Prieto Jiménez, Inmaculada Rey Losada, Francisco Jesús Salgado Seara, José Manuel Sousa Castillo, Ana 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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT3	CT3 Oral and written proficiency in the own language.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
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 CT3 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 CT3 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.

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.

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.

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

(*)Física: Física I/V12G350V01102
(*)Matemáticas: Álxebra e estatística/V12G350V01103
(*)Matemáticas: Cálculo I/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.

IDENTIFYING DATA				
Materials science and technology				
Subject	Materials science and technology			
Code	V12G363V01301			
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 Pena Uris, Gloria María Abreu Fernández, Carmen María			
Lecturers	Díaz Fernández, Belén			
E-mail	cabreu@uvigo.es raulfm@uvigo.es gpena@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			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Application of knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
Understand the main concepts about chemical bonds, structure and microstructure of different types of materials	CG3	CE9	CT10
Understand the relationship between microstructure and properties (mechanical, electrical, thermal and magnetic) in a material	CG3	CE9	
Understand the mechanical performance of metallic, ceramic, plastic and composite materials.	CG4 CG6		
Know the possibilities of modification of material properties through mechanical processing and thermal treatment	CG4	CE9	CT9
Know the main techniques for materials characterization	CG3 CG6	CE9	
Acquire abilities in handling materials diagrams and charts			CT1
Acquire abilities in undertaking standardized tests on materials, under supervision	CG6	CE9	CT10
Analysis of the obtained results and draw conclusions from them			CT1 CT5 CT9
Competence to apply standards to 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: aims, fundamentals and classification. Annealing, normalizing, quenching and tempering. Nonferreous alloys.
Plastic materials	Classification accoording to the molecular structure: Thermoplastics, thermosets and elastomers. Properties and assessing methods. Forming processes. Introduction to the Composite Materials.
Ceramic materials	Classification and properties. Glasses and traditional ceramics. Technical Ceramics. Cements: phases, types and main applications. Concrete. Processing of ceramic materials.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	31	56	87
Laboratory practical	16.75	18	34.75
Autonomous problem solving	0	12.2	12.2
Mentored work	0.5	9	9.5
Problem and/or exercise solving	1.5	0	1.5
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	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
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 instructor will propose several projects to be carried out in small groups. The projects with be related to the characterization of materials commonly used in technological applications. Students must complete a revision of the literature concerning to the topic of the project, revise the existing standards and other sources of information. Finally, the project must be exposed to the instructor and to their 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	1	CG3 CG6	CE9	CT1 CT9 CT10
Problem and/or exercise solving	Student learning in practical sesions will be evaluated by means of a written exam, which will include of exrcices and problems (7%) The final exam will include of problems and exercises similar to those raised during the course (35%)	42	CG4 CG6	CE9	CT1 CT9 CT10
Presentation	The projects will be assessed after the oral exposition. These are the items to be taken into account for the assessment: revised literature, structure of the contents used in the presentation and ability to reply to the comments given by the instructor and/or classmates.	7	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.	4	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 practical sesions will be evaluated by means of a written exam, which will include of short answer questions and test questions (7%) The final exam will include hort answer questions and test questions (35%)	42	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**, 2ª, Reverté, 2016

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

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

Complementary Bibliography

Smith, William F, **Fundamentos de la ciencia e ingeniería de materiales**, 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**, 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

IDENTIFYING DATA				
Basics of circuit analysis and electrical machines				
Subject	Basics of circuit analysis and electrical machines			
Code	V12G363V01302			
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 Villanueva Torres, Daniel			
Lecturers	González Estévez, Emilio José Antonio Villanueva Torres, Daniel			
E-mail	emilio@uvigo.es dvillanueva@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CE10	CE10 Knowledge and use of the principles of circuit theory and electrical machines.
CT2	CT2 Problem solving.
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. Security requirements 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 "writing 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, material employed, results obtained and interpretation of them. The realisation of practices and the presentation of the memories, form 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 examination 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 examination written additional that propose to this effect.

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

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, 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 of group:

Groups

E1 (teoria and practise): EDELMIRO MIGUEZ GARCIA

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.

IDENTIFYING DATA				
Mechanism and machine theory				
Subject	Mechanism and machine theory			
Code	V12G363V01303			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	English			
Department				
Coordinator	Fernández Vilán, Ángel Manuel Segade Robleda, Abraham			
Lecturers	Segade Robleda, Abraham			
E-mail	asegade@uvigo.es avilan@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This subject is intended to provide the students with basic knowledge about Mechanism and Machine Theory as well as his applications in the field of Mechanical engineering. It also covers and provides the students with the most important concepts related with Mechanism and Machine Theory. The students will know and apply kinematic and dynamic analysis methods for mechanical systems both with graphical and analytical methods and also through effective use of simulation software. Furthermore, this subject serves as an introduction of some aspects about machinery design; a topic that will be cover thoroughly in future subjects of the Degree.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
CE13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
CT2	CT2 Problem solving.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.
CT16	CT16 Critical thinking.

Learning outcomes	Competences		
To know the fundamentals of Mechanism and Machines Theory, and the application of these concepts concerning to the field of Mechanical engineering to solve problems related with this subject in the Industrial Engineering field.	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16
To know, comprehend, apply, and practice the concepts related to Mechanism and Machines Theory.	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16
To know and apply kinematic and dynamic analyses techniques to mechanical systems.	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16
Efficiently know and utilize software for analysis of mechanisms.	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16

Contents
Topic

Introduction to mechanism and machine theory	Introduction Definition of Machine, Mechanism and Kinematic Chain Link/part and linkage/joint Classification Kinematic Diagram, modeling, and symbology (nomenclature) Mobility Degrees of freedom Synthesis of mechanisms
Geometrical analysis of mechanisms.	Introduction Calculation methods of placement Loop closure equations
Kinematic analysis of mechanisms	Fundamentals Graphical methods Analytical methods Matrix methods
Static analysis of mechanisms	Fundamentals Force reduction (Graphical Methods) Work/Power Virtual Methods
Dynamic analysis of mechanisms	Fundamentals Machine general dynamics Machine Work and Power Balanced Dynamics of rotors
Cam mechanisms	Fundamentals Flat cams Cam synthesis
Power transmission mechanisms	Fundamentals Gears Mechanism Other mechanisms

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	19.5	42.5
Problem solving	9.5	30	39.5
Laboratory practical	18	47	65
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	Clase magistral en la que exponen los contenidos teóricos.
Problem solving	Resolución de problemas utilizando los conceptos teóricos presentados en aula.
Laboratory practical	Realización de tareas prácticas en laboratorio docente o aula informática

Personalized assistance

Methodologies	Description
Lecturing	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers .
Problem solving	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.
Laboratory practical	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.

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	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16

Essay questions exam	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded.	80	CG3 CG4	CE13	CT2 CT9 CT10 CT16

Other comments on the Evaluation

Students must achieve a 5 or higher grade* to pass the subject, following these rules:

- Laboratory Practical.
  - 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.
  - 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.
- Essay questions exam. It 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).
Tests Schedule: This information can be found along with any updates at the center (university) webpage.

Sources of information

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., **Theory of Machines and Mechanisms**, 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, **Mechanisms and dynamics of machinery**, Limusa-wyley,
Nieto, j., **Síntesis de Mecanismos**, AC,
Erdman, A.G.; Sandor, G.N.,, **Mechanism Design: Analysis and Synthesis**, PRENTICE HALL,
Simon A.; Bataller A; Guerra .J.; Ortiz, A.; Cabrera, J.A., **Fundamentos de teoría de Máquinas**, BELLISCO,
Kozhevnikov SN, **Mecanismos**, Gustavo Gili,

Recommendations

Subjects that continue the syllabus

Machine design I/V12G380V01304
Automobiles and railways/V12G380V01941
Design of hydraulic machines and oleo-pneumatic systems/V12G380V01914
Machine design II/V12G380V01911
Computer-aided mechanical design/V12G380V01915
Transport engineering/V12G380V01945
Thermal engines and machines/V12G380V01913
Systems for data analysis, simulation and validation/V12G380V01933
Hybrid and electric automotive vehicles/V12G380V01944

Subjects that it is recommended to have taken before

Graphic expression: Graphic expression/V12G380V01101
Physics: Physics I/V12G380V01102
Mathematics: Algebra and statistics/V12G380V01103
Mathematics: Calculus I/V12G380V01104
Mathematics: Calculus II and differential equations/V12G380V01204

Other comments

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

IDENTIFYING DATA				
Automation and control fundamentals				
Subject	Automation and control fundamentals			
Code	V12G363V01304			
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 Rodríguez Diéguez, Amador			
Lecturers	Fernández Silva, María Garrido Campos, Julio			
E-mail	amador@uvigo.es 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.			

Skills
Code

Learning outcomes	
Learning outcomes	Competences

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	
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	

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
Computer Science: computer science for engineering/V12G420V01203

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.

IDENTIFYING DATA				
Basics of operations management				
Subject	Basics of operations management			
Code	V12G363V01305			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Mejías Sacaluga, Ana María			
Lecturers	Doiro Sancho, Manuel Mandado Vazquez, Alfonso Mejías Sacaluga, Ana María Sartal Rodríguez, Antonio			
E-mail	mejias@uvigo.es			
Web				
General description				

Skills	
Code	
CG8	CG8 Ability to apply the principles and methods of quality.
CG9	CG9 Ability to organize and plan within the sphere of a company, and other institutions and organizations.
CE15	CE15 Basic knowledge of production systems and manufacturing.
CE17	CE17 Applied knowledge of business organization.
CT1	CT1 Analysis and synthesis.
CT2	CT2 Problem solving.
CT7	CT7 Ability to organize and plan.
CT8	CT8 Decision making.
CT9	CT9 Application of knowledge.
CT11	CT11 Planning changes to improve overall systems.
CT18	CT18 Working in an international context.

Learning outcomes			
Learning outcomes	Competences		
New	CG8 CG9	CE15 CE17	CT1 CT2 CT7 CT8 CT9 CT11 CT18

Contents	
Topic	
(*)PART *I. CURRENT SURROUNDINGS And PRODUCTIVE SYSTEMS (3*h)	(*)1.1.CURRENT SURROUNDINGS OF THE COMPANY 1.2.THE PRODUCTIVE SYSTEMS And THE MEASURE OF THE PRODUCTIVITY1.3.CONCEPT OF MANAGEMENT OF PRODUCTION. FUNCTIONS
(*)PART *II. FORECAST OF THE DEMAND	(*)2. INTRODUCTION. COMPONENTS. METHODS OF FORECAST OF THE DEMAND3.QUANTITATIVE METHODS OF FORECAST
(*)PART *III. MANAGEMENT OF INVENTORIES And MANAGEMENT OF PRODUCTION	(*)4.BASIC CONCEPTS OF CONTROL And MANAGEMENT OF INVENTORIES5.CONTROL OF INVENTORIES6.MANAGEMENT OF INVENTORIES IN INDUSTRIAL COMPANIES
(*)PART *IV. MANAGEMENT OF PRODUCTION IN INDUSTRIAL COMPANIES	(*)7.PLANNING OF PRODUCTION. PLAN ADDED. MASTER PLAN OF PRODUCTION 8.PLANNING OF NEEDS OF MATERIAL (*MRP)9.PLANNING OF NEEDS OF CAPACITY (*CRP) 10.PROGRAMMING OF PRODUCTION. CRITERIA And BASIC RULES
(*)PART *V. INTRODUCTION AL STUDY OF THE WORK	(*)11.INTRODUCTION AL STUDY OF THE WORK. STANDARDISATION OF OPERATIONS.12. DISTRIBUTION IN PLANT

(*)PART SAW. THE PHILOSOPHY JUST IN TIME (*JIT)	(*)12.THE PHILOSOPHY *JUST *IN *TIME (*JIT). DEFINITION And OBJECTIVE. ELEMENTS. OTHER APPROACHES OF IMPROVEMENT 13. SOFTENED OF THE PRODUCTION.
(*)PART *VII. INTRODUCTION To THE MANAGEMENT OF THE QUALITY, THE SECURITY And THE ENVIRONMENT	(*)14. INTRODUCTION To THE MANAGEMENT OF THE QUALITY, THE SECURITY And THE ENVIRONMENT
(*)PRACTICAL	(*)1. INTRODUCTION 2.FORECAST OF THE DEMAND3. CONTROL OF INVENTORIES4. MANAGEMENT OF INVENTORIES5. PLANNING OF THE PRODUCTION *I6. PLANNING OF THE PRODUCTION *II7. LISTS OF MATERIALS And OPERATIONS8. PLANNING OF THE CAPACITY9. PROGRAMMING OF THE PRODUCTION10. GLOBAL CASE OF MANAGEMENT OF PRODUCTION

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	64.5	97
Practices through ICT	18	18	36
Objective questions exam	6	6	12
Laboratory practice	2	3	5

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

Methodologies

	Description
Lecturing	(*)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.
Practices through ICT	(*)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.

Personalized assistance

Methodologies	Description
Lecturing	
Practices through ICT	

Assessment

	Description	Qualification	Evaluated Competencess		
Objective questions exam	(*)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
Laboratory practice	(*)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

Sources of information

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

Recommendations

IDENTIFYING DATA				
Electronic technology				
Subject	Electronic technology			
Code	V12G363V01401			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	English			
Department				
Coordinator	Verdugo Mates, Rafael Soto Campos, Enrique			
Lecturers	Soto Campos, Enrique			
E-mail	esotoc@uvigo.es rverdugo@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CE11	CE11 Knowledge of the fundamentals of electronics.
CT2	CT2 Problem solving.
CT9	CT9 Application of 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
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

IDENTIFYING DATA				
Fundamentals of manufacturing systems and technologies				
Subject	Fundamentals of manufacturing systems and technologies			
Code	V12G363V01402			
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	Areal Alonso, Juan José Diéguez Quintas, José Luís			
E-mail	jdieguez@uvigo.es			
Web	http://moovi.uvigo.es			
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.			

Skills
Code

Learning outcomes	
Learning outcomes	Competences

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	Type A test (for all students -75% final grade-) The character of this test is written and face-to-face, it is compulsory for all students, with or without continuous evaluation. It will be composed of 25 multiple choice questions on the theoretical and practical content. The evaluation of the multiple choice test will be carried out on a scale of 7.5 points, which represents 75% of the total mark, being necessary to obtain at least 2.5 points, so that together with the practical tests it is possible to obtain the minus 5 points and pass the subject. The grade for this test will be obtained by adding 0.3 points for each question answered correctly and 0.1 points will be deducted if the question is answered incorrectly. Blank questions do not score.	75
Laboratory practice	Type B test (continuous assessment -15% final grade-): A test to be carried out in the practical class schedule consisting of carrying out a numerical control program that mechanizes the piece that is presented to you. Type C test (continuous assessment -10% final grade-): A written test or work to be proposed by the teacher throughout the semester. This test will be valued with a maximum of 1 point, 10% of the final grade. The notes of tests A, B and C will be added, in order to obtain at least 5 points and pass the subject. Type D test (waiver of continuous assessment, 25% final grade): Resolution of various practical problems, whose value will be 25% of the final grade, that is, a maximum of 2.5 points. It is necessary to obtain a minimum of 1 point in this test so that the qualification can be added to that of the type A test and to be able to obtain at least 5 points to pass the subject. This type D test will be carried out exclusively by students who have been granted the waiver of continuous assessment, and it will be carried out on the same day that the compulsory type A test is carried out, after it has finished.	25

Other comments on the Evaluation

PASSED

Qualified students through continuous evaluation:

To pass this subject it is necessary to obtain at least 5 points by adding the score of the tests types 'A', 'B' and 'C', in the conditions previously exposed.

Qualified Students Granted Waiver of Continuous Assessment:

To pass this subject it is necessary to obtain at least 5 points by adding the score of the 'A' and 'D' tests, under the conditions set forth in their respective sections.

ATTENDANCE TO THEORETICAL AND PRACTICAL CLASSES

Attendance at theoretical and practical classes is not mandatory, but what is taught in them will always be subject to examination.

PERFORMANCE OF CONTINUOUS ASSESSMENT TESTS

Carrying out these type 'B' and 'C' tests is not mandatory, but if they are not carried out, up to 2.5 points will be lost, which is the total value of these tests.

If these tests are carried out and the subject is not approved, its value is not saved from one course to another.

EXTRAORDINARY CALL (Minutes of 2nd edition / July)

Qualified students through continuous evaluation:

This second call will be graded as follows:

- By completing the mandatory type 'A' test.

- The qualifications of the type 'B' test are kept in this 2nd opportunity, but it will be possible, if desired, to improve this qualification, by carrying out a new machine tool programming test, which will be a test type, at the end of the type 'A' test.

- The score achieved in the type 'C' test will be maintained, but this mark can be improved if desired by means of a new written test or work, which will be similar, to be delivered on the date that is published, before the day of the call of this second edition.

To pass this subject it is necessary to obtain at least 5 points by adding the three previous tests and meeting the same minimum requirements as in the 1st edition.

The marks of the continuous evaluation tests, corresponding to 25% of the final grade, will not be kept from one course to another.

Qualified Students Granted Waiver of Continuous Assessment:

Students who do not carry out continuous assessment, because the center has accepted their resignation, must always take the type 'A' test and the type 'D' test, in the terms specified in the previous sections.

To pass this subject it is necessary to obtain at least 5 points by adding the two previous tests.

EXTRAORDINARY END-OF-CAREER CALL:

This test will be the same for all students and will consist of a type 'A' test and a type 'D' test, in the terms specified in the previous sections.

To pass this subject it is necessary to obtain at least 5 points by adding the two previous tests, fulfilling the same minimum requirements as in the ordinary calls.

ETHICAL COMMITMENT:

The student is expected to present an appropriate ethical behavior, free from fraud. In case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices...) 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 fail (0.0).

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 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.

IDENTIFYING DATA				
Fluid mechanics				
Subject	Fluid mechanics			
Code	V12G363V01403			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	English			
Department				
Coordinator	Paz Penín, María Concepción Meis Fernández, Marcos			
Lecturers	Gil Pereira, Christian Meis Fernández, Marcos			
E-mail	mmeis@uvigo.es cpaz@uvigo.es			
Web				
General description	This syllabus presents information the Fluid mechanics course that belongs to the 2nd year of the degree in Industrial Technologies Engineering, 2020-2021, in accordance to the marked guidelines by the European Space of Upper Education. This is a first course in fluid mechanics, focusing on the topics that are relevant to Industrial Technologies Engineering applications. The course is intended to acquire essential knowledge needed to analyze devices with fluid as a working material, such us hydraulic machinery, lubrication devices, heating and cooling systems, pipes systems, pneumatic systems, aero and hydrodynamics devices, windturbines, etc. It includes stress and strain rate descriptions, fluid statics, use of differential and finite control volume analysis with continuity, momentum, and energy equations, Bernoulli and Euler equations, incompressible viscous flow using Navier-Stokes equations, dimensional analysis, laminar and turbulent pipe flow.			

Skills	
Code	
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Problem solving.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.

Learning outcomes			
Learning outcomes	Competences		
Knowledge for the realisation of measurements, calculations, assessments, evaluations, studies, reports, plans of works and other analogous works	CG4 CG5	CE8	CT2 CT9 CT10
Capacity to: solve problems with initiative and creativity, take decisions, develope critical reasoning and capacity to communicate and transmit knowledge and skills in the field of the industrial engineering	CG4 CG5	CE8	CT2 CT9 CT10
Knowledge of the basic principles of the fluid mechanics and his application to the resolution of problems in the field of the engineering. Intended learning outcomes are, understanding of the basics of flow behaviour in engineering systems, awareness of the physical laws that govern fluid motion and development of analytical skills for simple flow systems, e.g. calculation of pipes, channels and fluid systems	CG4 CG5	CE8	CT2 CT9 CT10
Resolution of problems	CG4 CG5	CE8	CT2 CT9 CT10

Contents
Topic

1. Introduction	1.1 Fundamental Concepts 1.1.1 Stress tensor. Newton Law 1.2 The Fluid as a Continuum 1.3 Viscosity 1.3.1 Newtonian Fluids and non Newtonian fluids 1.4 Characteristics of the flows 1.4.1 Different types of flows 1.4.1.1 Geometrical conditions 1.4.1.2 Kinematic conditions 1.4.1.3 Mechanical conditions 1.4.1.4 Compressibility 1.5 Stresses on a fluid 1.5.1 Tensorial and vectorial magnitudes 1.5.1.2 Volumetric Forces 1.5.2.2 Surface Forces 1.5.2.3 The stress tensor 1.5.2.4 Concept of pressure
2. Basic Physical Laws of Fluid Mechanics	2.1 Velocity field 2.2 Streamlines and pathlines 2.3 Systems and Control volumes 2.4 Integrals extended to Fluid volumes. The Reynolds Transport Theorem 2.5 Conservation of Mass. Integral and Differential Equation 2.6 The Linear Momentum Equation. Integral and Differential Equation. 2.7 Navier-Poisson Law 2.8 The Energy Equation. Integral and Differential Equation. Frictionless Flow: The Bernoulli Equation
3. Dimensional Analysis. Similarity concepts	3.1 Introduction 3.2 The Pi Theorem 3.3 Applications 3.4 Fundamental Nondimensional Numbers in Fluid Mechanics 3.4.1 Physical meaning of the nondimensional numbers 3.5 Similarity in Fluid dynamics 3.5.1 Partial Similarity 3.5.2 Scaling effect
4. Laminar viscous flow	4.1 Introduction 4.2. Fully developed flow 4.2.1 Hagen-Poiseuille Flow 4.2.2 Viscous flow in circular ducts 4.2.3 Flow in Noncircular Ducts 4.3 Entrance region effect 4.4 Losses in Pipe Systems 4.4.1 Friction coefficient 4.5 Stability of laminar flow
5. Turbulent Flow in ducts	5.1 Introduction 5.2 Pipe-head Loss in turbulent regime 5.2.1 Nikuradse chart 5.2.2 Moody chart 5.2.3 Empirical Formulas for flow in circular ducts. Hydraulic diameter
6. Minor Losses in Pipe Systems	6.1 Introduction 6.2 Minor Losses6.2.1 Loss at the entrance of a pipe 6.2.2 Loss at the exit of a pipe 6.2.3 Loss at contractions 6.2.4 Loss at expansions 6.2.5 Loss at elbows 6.2.6 Losses at bends, elbows, tees and valves 6.3 Pipes in series 6.4 Pipes in parallel 6.5 The three-reservoir pipe junction problem 6.6 Pipings netwoks 6.7 Nonsteady effects in duct flows 6.7.1 Emptying time of a tank 6.7.2 Setting of the steady flow in a pipe 6.7.3 Water hammer

7. Open-Channel Flow	7.1 Introduction 7.2 Uniform Flow 7.2.1 Pipes used like channels 7.3 Non uniform flow 7.3.1 The hydarulic jump 7.3.2 Fast transitions 7.3.3 Flow over a gate 7.3.4 Flow under a gate 7.3.5 Section of control
8. Experimentation withFflows. Discharge Measurement. Pressure Measurement. Speed Measurement	8.1 Pressure Gauge 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 Prandtl tube 8.2.3 Rotative anemometer 8.2.4 Hot thread anemometer 8.2.5 Laser-doppler anemometer 8.3 Flow measurement 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
Objective questions exam	1.5	0	1.5

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

Methodologies

	Description
Lecturing	They explain the foundations of each subject needed to solve practical problems. It includes mainly lectures baut can also includes: Readings bibliographic Review Solution of problems Conferences Oral Presentations
Problem solving	They will apply the concepts tackled in the lectures. It includes activities such as: Readings Seminars Solution of problems Team working Study of practical cases
Mentored work	Works of practical applications, projects, design, creative and novelty subjects of practical applications of fluid mechanics
Laboratory practical	Fundamentally, they will consist on activities of experimentation, although they also can include: Practical cases Simulation Solution of problems Team working

Personalized assistance

Methodologies	Description
Lecturing	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students (Faitic)

Laboratory practical	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students (Faitic)

Assessment

	Description	Qualification	Evaluated Competencess		
Problem solving	Resolutions of practical problems related with the contained imparted in one specific topic of theory	8	CG4		CT2 CT9
Mentored work	Works of application and demonstration of basic principles of fluid mechanics	2	CG4		CT9
Essay questions exam	Proof written that it will be able to consist of: theoretical questions practical questions resolution of exercises/problems fear to develop	80	CG4 CG5	CE8	CT2 CT9 CT10
Laboratory practice	Execution of practical cases in Laboratory. Report of the activities realized in the sessions of laboratory, results of the experimentation, etc.	5	CG4 CG5	CE8	CT2 CT9 CT10
Objective questions exam	Short written proofs, that can be of practical questions of laboratory or of conteptos of theor	5	CG4	CE8	CT9

Other comments on the Evaluation

Continuous evaluation: it represents 20% of the note. Except official indication from the center direction of the renunciation of the student to the continuous evaluation, the student follows the course in this modality.

Continuous evaluation is considered until July, so the qualifications achieved in all the activities previously carried out are kept until the July Final Exam. The exact percentages may deviate slightly from those indicated due to the management, or feasibility of carrying out the different practical tests, and attributing to the complementary activity (work and projects) a higher qualification and, may even exceed 10 as the maximum qualification achievable.

In any case, the weight of 80% of the long answer test will remain unchanged.

The student is expected to exhibit adequate ethical behaviour. In case of noticing a non-ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices, and others) it will be considered that the student does not gather the necessary requirements to pass the course. In this case, the global qualification of the present academic course will be failed (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 present academic course and the global qualification will be failed (0.0).

Sources of information

Basic Bibliography

Frank M White, **Mecánica de Fluidos/Fluid Mechanics**, VI,

Robert L. Mott, **Mecánica de fluidos**, VI,

Antonio Crespo, **Mecánica de fluidos**,

Complementary Bibliography

Robert W. Fox, Alan T. McDonald, **Introducción a la mecánica de fluidos**,

Merle C. Potter, David C. Wiggert ; con Miki Hondzo, Tom I.P. Shih, **Mecánica de fluidos/Mechanics of Fluids**, III,

Victor L. Streeter, E. Benjamin Wylie, Keith W. Bedford, **Mecánica de fluidos/Fluid Mechanics**, IX,

Yunus A. Çengel, John M. Cimbala, **Mecánica de fluidos : fundamentos y aplicaciones**,

Elena Martín Ortega, Concepción Paz Penín, **Prácticas de laboratorio de mecánica de fluidos**,

Philip M. Gerhart, Richard J Gross, , Jonh I. Hochstein, **FUNDAMENTOS DE MECANICA DE FLUIDOS**, II,

Recommendations

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:
Attend to class
Spend the hours outside the classroom studying the subject

IDENTIFYING DATA				
Mechanics of materials				
Subject	Mechanics of materials			
Code	V12G363V01404			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Riveiro Rodríguez, Belén Conde Carnero, Borja			
Lecturers	Conde Carnero, Borja Riveiro Rodríguez, Belén			
E-mail	bconde@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.			

Skills
Code

Learning outcomes	
Learning outcomes	Competences

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	
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	
Essay questions exam	Written exam in the dates established by the School.	85	

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.

IDENTIFYING DATA				
Termodinámica e trasmisión de calor				
Subject	Termodinámica e trasmisión de calor			
Code	V12G363V01405			
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	Morán González, Jorge Carlos			
Lecturers	Morán González, Jorge Carlos Santos Navarro, José Manuel			
E-mail	jmoran@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 *complemantan os contidos da materia, completado con algunha práctica con software específico CONTIDOS PRÁCTICOS: (polo menos realizaranse 3 das prácticas propostas) 1)Aplicacións do Primeiro Principio: Determinación Experimental dos Procesos *Isotermos e *Adiabáticos 2)Avaliando Propiedades Termodinámicas de Sustancias Puras mediante o uso de software informático 3)Estudo Experimental dun Ciclo de Vapor 4)Estudo Experimental dun Ciclo de Refrixeración por *Compresión de Vapor e funcionamento como Bomba de Calor 5)Cálculo Experimental da Condutividade Térmica en Placas 6)Avaliando a Transferencia de Calor por Radiación: Lei de *Stefan-*Boltzmann
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 (sesións de teoría, prácticas de laboratorio, etc.), e en tempo/condicións establecido/*as polo profesor 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	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. Esta nota corresponderase coa denominación de Avaliación Continua	20	CG6	CE7	CT2 CT7 CT9 CT10

Other comments on the Evaluation

Modalidade de seguimiento por Avaliación Continua.

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

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.

Cada matricula na asignatura, 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 evaluable recolleita na Guía Docente da asignatura, serán considerados como "presentados" e teráselles en conta para a cualificación final

Para a realización das probas consideradas como Avaliación Continua, a realizar ao longo do curso, o alumno deberá ir provisto dos materiais e/ou documentación necesarios pararealizarla: calculadora (non-programable), táboas e diagramas de propiedades daquelas sustancias que se estudan. Non se permitirá ningunha clase de formulario ou similar nestas probas

Nas diferentes probas de avaliación continua e exame final aconséllase ao alumnado que xustifiquen todos os resultados que consigan. Non se dará ningún resultado por ?sobreentendido? e terase en conta o método empregado para chegar á solución proposta

Modalidade de renuncia á Avaliación Continua.

Aqueles alumnos que obteñan oficialmente a renuncia á avaliación continua, utilizando as canles previstas pola escola, serán evaluados, nas datas oficiais fixadas polo centro das dúas convocatorias/edicións, mesmo día e hora, mediante unha avaliación específica. Esta proba de avaliación específica terá en conta todos os contidos impartidos na asignatura (teoría, problemas e prácticas de laboratorio), e supoñerá o 100% da nota máxima. Levarase a cabo da seguinte forma:

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

2.-Unha proba específica (EC), cun peso dun 20% sobre a cualificación final. Esta proba específica incluirá tanto os contidos de prácticas de laboratorio como os impartidos nas sesións de teoría

Criterios de cualificación.

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

$CF= 0.2 \cdot EC + 0.8 \cdot EF$

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

CF= máximo(N1, N2), sendo,

$N1= 0.2 \cdot EC + 0.8 \cdot EF$

N2= EF

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

Os exames da convocatoria fin de carreira poderán ter un formato de exame distinto ao detallado anteriormente.

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 a 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, plagio, 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).

Nos e permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado no 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

IDENTIFYING DATA				
Applied electrotechnics				
Subject	Applied electrotechnics			
Code	V12G363V01501			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Novo Ramos, Bernardino			
Lecturers	Novo Ramos, Bernardino			
E-mail	bnovo@uvigo.es			
Web				
General description	The objective of Applied Electrotechnic is to complete the training of the students of the Industrial Technologies Degree in what is related with Three-phase Systems and Power Transformers. This subject will provide specific tools to analyse and evaluate the behaviour of the most usual electrical installations under balanced and unbalanced situations. The subject is conceived also, to provide the necessary knowledge and competencies to be able to follow some subjects in the 3rd and 4rd years of the Degree. The students have to be familiar with subjects like "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 Applied Electrotechnic, without and extra effort			

Skills
Code

Learning outcomes	
Learning outcomes	Competences

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-phase circuits under either balanced or unbalanced conditions Initially the unit covers the basic concepts for the analysis of balanced circuits. It continues analyising unbalanced circuits, the different methods to measure the electrical powers and the compensation of the 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 its characteristic parameters and to understand the machine main properties and its utilization in the electrical 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
Lecturing	20	60	80
Problem solving	9	18	27

Collaborative Learning	9	9	18
Laboratory practical	9	9	18
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
Lecturing	The usual lecture
Problem solving	The professor will guide the first steps of the alumni in order to show them how to analyse diferent problems/sytuations and how to solve them
Collaborative Learning	Once taght how to solve a "generalistic problem" the alumni will heve to create groups to find out the solutions to same proposed problems related with the subject. They will be requested to collaborate in order to hand the professor the proper solution at the end
Laboratory practical	Experimental solving of of proposed lab tests, realization of measurements and presentation of results.

Personalized assistance

Methodologies	Description
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. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Lecturing	he 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. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Problem solving	he 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. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed

Assessment

	Description	Qualification	Evaluated Competencess
Lecturing	It will cover 40% of the mark of the second part assesment	20	
Problem solving	It will cover 100% of the mark of the first part assesment It will cover 40% of the mark of the second part assesment	70	
Laboratory practical	included in the second part theory test. They will be valued as a 10% of the final mark	10	

Other comments on the Evaluation

Continuous assessment (100%):

At the end of each Part (I & II) the student will perform a test that will be scored from 0 to 10 points. The passing mark is 5. The test will cover theoretical issues and practical exercisesIn each Part the student can reach 50% of the final mark. The passed partial tests are released from the corresponding part in the final exam.
For the students who pass all tests, the final mark will be the average of the marks of the partial tests.
Students who fail any or all partial tests, will have take a final exam whrere she/he 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 part and an avereage mark bigger than 5.
Students approved by partial tests can modify (maybe improve) their mark by presenting to the final exam.
The professors will indicate the dates and places of publication of marks and revisions

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Electrical machines/V12G363V01605

Subjects that are recommended to be taken simultaneously

Physics: Physics 2/V12G363V01202
Mathematics: Calculus 2 and differential equations/V12G363V01204

Subjects that it is recommended to have taken before

Basics of circuit analysis and electrical machines/V12G363V01302

Other comments

Requirements: To enrol in this subject is necessary either to had surpassed or to be enrolled in all the subjects of the previous courses of the one where this subject is summoned

IDENTIFYING DATA				
Materials engineering				
Subject	Materials engineering			
Code	V12G363V01502			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	English			
Department				
Coordinator	Díaz Fernández, Belén			
Lecturers	Díaz Fernández, Belén			
E-mail	belenchi@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject combines the scientific fundamentals that prove the relation structure-properties-performance with technological aspects such as the manufacturing processes and the service conditions.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Application of knowledge.
CT10	CT10 Self learning and work.
CT15	CT15 Objectification, identification and organization.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
Knowledge of the main manufacturing and transformation processes used in the industry	CG3	CE19	CT1
Probe the ability to select the most suitable forming process for each material	CG4		CT5
Knowledge of the joining processes used in the industry	CG5		CT7
Understand the complex relations between the properties of materials and the forming and joining processes in order to improve properties and to increase productivity	CG6		CT9
	CG11		CT10
Knowledge of the characteristics of the materials used in engineering			CT15
Knowledge of the several types of materials and processes for their forming			CT17
Knowledge of the criteria for the selection of the most suitable material for an specific application			
Propose operative solutions for the most common problems in the materials engineering field			
Analyse conclusions and results of tests and measurements			
Write with a suitable structure. Make a presentation with the available media			
Show the aptitude of communication and working in teams			
Identify the need of information and use the available media and services to design and perform a suitable search in the subject area			
Perform the assigned projects following the indications given by the lecturer			

Contents
Topic

Unit I: In-service materials performance.	Lesson 1. Fatigue Definition and importance. Fracture surface characteristics. S-N curve. Fatigue crack propagation and service life prediction. Cumulative fatigue damage: Palmgren-Miner□s rule. Influence of the mean stress: Goodman and Gerber criteria. Factors that influence on fatigue. Lesson 2. Fracture mechanics. Griffith and Irwin theories. Linear elastic fracture mechanics. Stress distribution at the crack tip: plain stress and plain strain. Plain strain fracture toughness. Lesson 3. Creep. Influence of temperature on strength. The creep curve: creep rate, creep strain, temperature and stress. Creep tests for metals and plastics. Influence of stress and temperature. Prediction of long-time properties. Development of creep resistant alloys. Materials selection. Deformation mechanisms. Lesson 4. Fundamentals of corrosion. Economic and social importance. Electrochemical corrosion. Thermodynamic analysis. Electrode potential and Pourbaix diagrams. Kinetic analysis. Corrosion rate. Polarization phenomena. Passivation. Corrosion control strategies: design, change of material and/or exposure environment, protective layers, cathodic and anodic protection.
Unit II: Metal-casting and forming processes, heat treatments and joining processes.	Lesson 5: Fundamentals of metal casting: especial casting methods. Castability: fluidity, no cavities and resistance to hot cracking. Casting alloys. Directional solidification, casting for single-crystal components and metallic glasses. Squeeze casting. Semi-solid forming (rheocasting and thixocasting). Lesson 6: Plastic forming of metals: cold working and hot forming. Strain hardening. Characteristics of cold working. Annealing of a cold-worked piece. Hot forming: dynamic recovery and dynamic recrystallization. Characteristics of hot forming. Benefits of hot forming for cast structures. Lesson 7. Heat treatments and thermomechanical treatments. Quench and hardenability. Tempering. Martempering and austempering. Thermomechanical treatments: definition and types. Controlled rolling, ausforming, isoforming and marforming. Lesson 8. Welding metallurgy. Classification of welding processes according to AWS. Thermal cycle: influencing factors. Weld zone: epitaxial and competitive growth. Heat affected zone. Solid solution strengthened alloys. Work-hardened alloys. Precipitation hardened alloys. Transformation hardening alloys. Post-welding treatments.
Unit III: Structural materials.	Lesson 9. Structural steels and stainless steels. Hot-rolled steels for general purposes. Microalloyed steels. Atmospheric corrosion resistant steels. Steels for quench and tempering. Low-temperature applications steels. Stainless steels. Passive layer characteristics. Classification. Lesson 10. Aluminum alloys. Strengthening of aluminum alloys. Classification of the aluminum alloys. Cast and wrought aluminum alloys. Lesson 11. Composite materials. Definition: advantages and drawbacks. Types of composite materials. Fiber-reinforced plastics: properties and fabrication. Laminated structures. Metallic and ceramic matrix composite materials.

Laboratory contents	Laboratory 1. Fractography and fatigue testing. Macroscopic and microscopic features of the fracture surfaces. Scanning Electron Microscope. Practical examples. Fatigue: general concepts. Fatigue testing: Wöhler curve. Factors that influence on fatigue. Examples. Laboratory 2. Corrosion technology. Corrosion protection. Electrochemical techniques for the corrosion assessment. Metallographic analysis. Assessment of protective layers. Thickness and adherence. Assessment of failure mechanisms. Laboratory 3. Metallography I: forming techniques. Cast structures: influence of cooling rate and alloying elements. Cold worked and hot formed structures. Laboratory 4. Metallography II: heat-treated alloys. Steels and Al alloys. Laboratory 5. Hardenability. Jominy test. Jominy curve. Objective and applications. Jominy test and results designation. Laboratory 6. Liquid penetrating and magnetic particles testing. Definition, objectives and applications. Testing methodology and report. Laboratory 7. Radiography and ultrasounds (I) Radiography: definitions, objectives and applications. Testing. Ultrasounds: through-transmission (transmitter-receiver) and pulse-echo modes. Ultrasonic inspection: calibration and thickness assessment. Laboratory 8. Ultrasonic inspection (II) Inspections of metallic pieces with a contact transducer. In-situ assessment of concrete structures. Sclerometer test: surface hardening and strength relationship. Ultrasonic inspections with the direct transmission mode. Ultrasonic pulse velocity in concrete: indirect mode. Ultrasonic pulse velocity and strength relationship. Laboratory 9. Exposition of projects. Each student will participate in the exposition of his/her group and will answer the questions posed either by the lecturer and/or by students from other groups.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	33	56	89
Problem solving	4	8	12
Seminars	3	3	6
Laboratory practical	13	19	32
Mentored work	0	11	11
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentations given by the lecturer of the main contents of the subject
Problem solving	Proposal of a set of problems/exercises that students must resolve by themselves. Guidelines, required formulas and common routines will be given in the classroom. Some problem will be resolved at the classroom, by the lecturer or by a student.
Seminars	Additional explanations to solve the main difficulties about the subject contents
Laboratory practical	Activities for application of the theoretical knowledge to particular situations and for the acquisition of basic skills and procedures related to the subject. Students will use the laboratories with the suitable equipment and devices.
Mentored work	Students, individually or in group, elaborate a document or presentation about some important topic related to the subject. Student can be asked to prepare a seminar, a short research, a summary of a document or conference...

Personalized assistance	
Methodologies	**Description**

Mentored work	Personalized attention, the lecturer will guide the preparation of the project. Any difficulty/doubt will be attended. This support can be provided either in person or electronically (email, videoconference, campus remoto ...) after being formally requested.
Seminars	Personalized attention, time devoted to help students with any difficulty or doubt. IThis support can be provided either in person or electronically (email, videoconference, campus remoto ...) after being formally requested.

Assessment

	Description	Qualification	Evaluated Competencess	
Lecturing	The assessment will be completed with two written exams of short questions, tests or exercises. The purpose is to assess the level of knowledge achieved along the course. One of the tests will be done during the teaching period (20%) and the other in the date established by the school	70	CG3 CG4 CG5 CG6 CG11	CT5 CT7 CT9 CT10 CT15
Laboratory practical	The laboratory activities will be assessed through the students attendance and participation, preparation of reports and a final test at the end of the teaching period	15		CT5 CT9 CT10 CT15 CT17
Mentored work	It will be assessed by the handed reports and/or the exhibition in the classroom of the prepared project.	15	CG3 CG4 CG11	CT9 CT10 CT15

Other comments on the Evaluation

FIRST ATTEMPT:

The continuous assessment will be followed during the teaching period of the subject according to the criteria established in the previous section. In the final exam, a minimum mark of 2 out of 5 is required in the own written exam to pass the subject. The mark will be the sum of the mark achieved in the final exam plus the mark achieved in the continuous assessment.

In case this minimum mark was not achieved, the whole mark will be that corresponding to the maximum achieved mark, either in the continuous assessment or in the final exam.

Students have the right to renounce to the continuous assessment system. This option must be formally asked. In this situation, the final exam will include the totality of the contents of the subject, and its qualification is 100%. The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es.

SECOND ATTEMPT (exam in July):

The qualification obtained from the continuous assessment will be kept, unless the student request to be cancelled in due course. In this situation, the totality of the contents of the subject (those given in the classroom and in the laboratory) will be included in this final exam and the student could achieved 100% of the qualification (the minimum mark to pass the exam will be 5 out of 10).

The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es.

EXTRAORDINARY CALL: the exam (questions, tests and/or exercises) will include the totality of the contents and the qualification will be 100%.

Ethical commitment: student is expected to show an ethical behaviour. In the case a non ethical behaviour is detected (copy, plagiarism, use of forbidden electronic devices, or others), the student will failed with a qualification of 0%.

Sources of information

Basic Bibliography

Kalpakjian, S. and Schmid, S. R.,, **Manufacturing Engineering and Technology**, Pearson/Prentice Hall,

Mikell P. Groover, **Fundamentals of Modern Manufacturing: Materials, Processes, and Systems**, John Wiley & Sons,

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

Complementary Bibliography

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

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

Krauss, G., **Steels: Heat Treatment and Processing Principles**, ASM International,
Brooks, CH., **Principles of the Surface Treatment of Steels.**, Inc. Lancaster,
Randall, M. G., **Sintering: Theory and Practice**, John Wiley & Sons,
Beeley, P., **Foundry Tecnology**, Butterworth-Heineman, Ltd.,

Recommendations

Subjects that continue the syllabus

Fundamentals of manufacturing systems and technologies/V12G363V01402
Mechanics of materials/V12G363V01404
Manufacturing engineering/V12G363V01604

Subjects that it is recommended to have taken before

Materials science and technology/V12G363V01301

IDENTIFYING DATA				
Physics 3				
Subject	Physics 3			
Code	V12G363V01503			
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	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).			

Skills	
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

IDENTIFYING DATA				
Hydraulic turbomachines				
Subject	Hydraulic turbomachines			
Code	V12G363V01504			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Meis Fernández, Marcos			
Lecturers	Meis Fernández, Marcos			
E-mail	mmeis@uvigo.es			
Web				
General description	This syllabus presents information the Hydraulic Turbomachines course that belongs to the 3rd year of the degree in Industrial Technologies Engineering, 2020-2021, in accordance to the marked guidelines by the European Space of Upper Education. This is a first course in Hydraulic Turbomachines, focusing on the topics that are relevant to Industrial Technologies Engineering applications. The course is intended to acquire essential knowledge about the fundamental principles and performance of Hydraulic Turbomachines, studying the main parts of a turbomachines and their classification, the application of fundamental Euler□s theorem, and the performance of both turbines and pumps with different arrangements in hydroelectric power plants and pumps stations, respectively. Finally, some brief comments are explained to acquire fundamental knowledge of fans, airfoils and positive displacement machines			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.

Learning outcomes		Competences	
Understand fundamentals of hydraulic machines	CG3	CE8 CE25	CT2 CT9 CT10
Acquire skills for sizing pumps facilities and fluid machines	CG3	CE8 CE25	CT2 CT9 CT10

Contents	
Topic	
1.- Introduction	1.- Turbomachinery. Classification 2.- Hydraulic turbomachines 3.- Applications to the Industry 4.- General specifications
2.- Transfer of Energy	1.- Equation of conservation of the energy 2.- Hydraulic turbomachines applications 3.- Dimensionless parameters 4.- Power and efficiencies
3.- Similarity and Characteristic Curves	1.- Similarity in hydraulic turbomachines 2.- Practical application of similarity laws 3.- Comparison of hydraulic turbomachines 4.- Characteristic curves in hydraulic pumps 5.- Characteristic curves in hydraulic turbines 6.- Dimensionless coefficients. Specific speed and specific power

4.- Transfer of Work	1.- Fundamental equation of hydraulic turbomachinery: Euler's equations. Expressions 2.- One-dimensional (ideal) theory of hydraulic turbomachinery 3.- Two-dimensional (ideal) theory of hydraulic turbomachinery 4.- Real flow. Losses 5.- Cavitation in HTM
5.- Fluids machines of low pressure rise	1.-Classification 2.- Fans. Characteristic curves 3.- Wind turbines. Classification - Disk actuator theory.Betz's limit - Fundamentals Theory of Airfols. NACA Airfoils - Blade element theory - Characteristic curves
6.- Positive displacement machines and hydraulic transmissions	1.- Types and classification 2.- Alternative and rotatory pumps. 3.- Hydraulic engines of positive displacement 4.- Transmissions and hydraulic couplings
Laboratory sessions	1. Introduction to the pneumatic systems: - detailed description of the pneumatic systems and his components. -Basic circuits. -Problems resolutions 2. Resolution of problems of of hydraulic turbomachines 3. Hydraulic turbines - Hill chart Francis Turbine 4. Resolution of problems of Positive displacemetn machines

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	Readings solution of problems
Laboratory practical	Practices of pneumatic (see description in contents) Practices of HTM (see description in contents)
Problem solving	Calculation methods and techniques Interpretation of results Practical cases

Personalized assistance	
Methodologies	**Description**
Problem solving	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students
Lecturing	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students
Laboratory practical	Personalized attention will be given to the students during class (throughout the possible questions that could arise) and during the specific timetable of the teacher for tutorships. Updated information of the tutorships timetables will be given to the students

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 - Short covering of a topic	80	CG3	CE8	CT2 CT9 CT10
Problem and/or exercise solving	Resolution of exercises proposed, including: -Short reports/exercises proposed	20	CG3	CE8	CT2 CT9 CT10
(*)	-	-			

Other comments on the Evaluation

Continuous evaluation: represents 20% of the grade, which consists of solving some proposed exercises. Except official renounce of the student, the course is followed under continuous assessment mode.

Continuous assessment grading is not saved year after year

Final exam (first call): 80% of the total mark, which consists of theoretical question, practical questions, resolution of exercises/problems or short covering of a topic

July final exam (second call): represents 100% of the grade (continous evaluation is not considered)

Ethical Commitment: In case of noticing a non ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices,and others) it will be considered that the student does not gather the necessaryrequirements to pass the course. In this case, the global qualification iof the present academic course will be failed (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
Srinivasan, K.M., **rotodynamic Pumps**, New Age International Publishers, 2008

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

Recommends to the student:
Attend to class
Spend the hours outside the classroom studying the subject

IDENTIFYING DATA				
Matemáticas da especialidade				
Subject	Matemáticas da especialidade			
Code	V12G363V01505			
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

Resultados de aprendizaxe	
Learning outcomes	Competences

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 dos 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 as dúbidas e preguntas do alumnado.
Prácticas con apoio das TIC	O profesor atenderá 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	
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	

Other comments on the Evaluation

Para os alumnos que renuncien á avaliación continua o examen 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**, 2018

F. De Arriba, A. Castejón, E. Corbacho, MC. Somoza, R. Vidal, **Implementacióne e desenvolvemento de aulas de xeometría euclídea e diferencial en Sage**, 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.

IDENTIFYING DATA				
Machine design and testing				
Subject	Machine design and testing			
Code	V12G363V01602			
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	Casarejos Ruiz, Enrique			
Lecturers	Casarejos Ruiz, Enrique González Baldonedo, Jacobo Segade Robleda, Abraham			
E-mail	e.casarejos@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Problem solving.
CT9	CT9 Application of 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
Lecturing	23	19.5	42.5
Problem solving	9	30	39
Laboratory practical	18	47	65
Objective questions exam	3.5	0	3.5

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

Methodologies

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

Personalized assistance

Methodologies	Description
Lecturing	Group or individual tutorial sessions will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers
Problem solving	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.
Laboratory practical	Group or individual tutorials will be held during office hours to strengthen the acquired knowledge and to guide and assess the proposed works/papers.

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
Objective questions exam	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded	80	CG3 CG4 CG5 CG6 CG11	CE13 CE26	CT2 CT9 CT16

Other comments on the Evaluation

Students must achieve 5 points (*) or higher grade to pass the subject, following these rules:

- Laboratory Practical.
    - 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. 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.
    - 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.
- Objective question exam. It will be graded in a test that have a minimum 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

IDENTIFYING DATA				
Elasticity and additional topics in mechanics of materials				
Subject	Elasticity and additional topics in mechanics of materials			
Code	V12G363V01603			
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	Comesaña Piñeiro, Rafael 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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Problem solving.
CT5	CT5 Information Management.
CT9	CT9 Application of 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.

IDENTIFYING DATA				
Manufacturing engineering				
Subject	Manufacturing engineering			
Code	V12G363V01604			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Prado Cerqueira, María Teresa			
Lecturers	Prado Cerqueira, María Teresa			
E-mail	tprado@uvigo.es			
Web				
General description				

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CE20	CE20 Applied knowledge of systems and manufacturing processes, metrology and quality control.
CT2	CT2 Problem solving.
CT8	CT8 Decision making.
CT9	CT9 Application of 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		
- Know the technological basis and the basics of manufacturing processes	CG3	CE20	CT2
- Understand the basics of manufacturing systems			CT8
- Acquire skills for the selection of manufacturing processes and developing manufacturing planning			CT9
			CT10
- Develop skills for making assemblies and parts in CADCAM environments			CT17
- Application of CAQ technologies			CT20

Contents	
Topic	
Thematic block I: Integration of product design and manufacturing.	Chapter 0. Product and process design. Chapter 1. Manufacturing systems. Chapter 2. Additive manufacturing technologies. Chapter 3. Design for manufacturing and assembly (DFMA).
Thematic block II: Design and planning of manufacturing processes.	Chapter 4. Design and planning methodologies for manufacturing processes. Chapter 5. Selection of operations, tools, equipment and process conditions. Chapter 6. Datum references, jigs, fixtures and equipments. Chapter 7. Design and process improvement techniques.
Thematic block III: Resources of manufacturing systems.	Chapter 8. Description and structure of CNC machine tools. Chapter 9. handlers and industrial robots. Positioning systems. Maintenance. Chapter 10. Measurement and verification systems in manufacturing lines. Definition of control ranges.

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 - Objectives - Theoretical classes - Practical classes - Assesment - Project development. Topic selection and work progress. - References
Problem solving	Development of real practical cases and exercises on the following contents 1. Plant distribution 2. Product and tools design 3. DFMA application 4. Application of dimensional, geometrical and surface finishing tolerances. 5. Sequence of manufacturing operations. 6. Setting of the conditions in manufacturing processes. 7. Calculation of cutting speeds, feeds, strengths and cutting powers in manufacturing. 8. Measurement procedures.
Laboratory practical	P1-2. PLM introduction. Product and process design. CAD software. Available software: Catia, NX, Fusion. 2 hour +2 hour P3. Part manufacturing process planning. Tooling design for product. 2 hour P4 -5 -6. Computer-aided tooling manufacturing, CAM prismatic, (Catia, NX, Fusion). 6 hour P7 -8 -9 Supervision of project development. 6 hour
Mentored work	Project (Work to make by student. It would correspond to Groups C of 5 students) Total 18*h
Lecturing	Development of the contents of the subject 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	- Test-type questions, marks will be deducted for incorret answer. - The test can involve problem and essay type questions.	50	CG3	CE20	CT2 CT8 CT9
Essay	Project development. Teamwork, creativity, self-sufficiency will be evaluated and in case of public presentation the ability for synthesis and communication	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 evaluationconsists of:

A.-) Multiplechoice exam: It´s mandatory. The students must have a mark > 4 (0 to 10) tobe able to make averarage with part B. Value 50%

PracticalPart, The student have to choose between *B1 or *B2

B1.-)Project. Value 50%

B2.-)Essaytype questions: problems and cases. Value 50%.

The finalmark is the average mark A +B, being B= B1 or B2

Ethical commitment:The student is expected to exhibit appropriate ethical behavior. In the case ofdetecting non-ethical behaviour (copy, plagiarism, utilisation of unauthorised electronicdevices, and others), it will be considered that the student does not gather thenecessary requirements to pass the subject. In this case the globalqualification in the present academic course will be fail (0.0).

Othercomments Requirements: To enrol in this subject is necessary to have passed orbe enrolled in all the matters of the previous courses.

ethical Commitment: it expects that the present student a suitable ethical behaviour. Inthe case to detect a no ethical behaviour (copy, plagiarism, utilisation ofunauthorised electronic devices, and others) will consider that the student does not gather the necessary requirements to surpass the matter. In this case theglobal 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.,

Notes of the ME subject,

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.

IDENTIFYING DATA				
Electrical machines				
Subject	Electrical machines			
Code	V12G363V01605			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language				
Department				
Coordinator	Novo Ramos, Bernardino			
Lecturers	Novo Ramos, Bernardino			
E-mail	bnovo@uvigo.es			
Web				
General description				

Skills
Code

Learning outcomes	
Learning outcomes	Competences

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 Usual construction: Magnetic poles. Windings. 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. AC motor protection and control switchgear. Security oriented control circuits Security oriented protection schemes II-2 Single-phase induction motor Construction characteristics. Operating principles. Electrical equivalent circuit. Starting methods.
UNIT III: SYNCHRONOUS MACHINES (GENERATORS)	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 Classic D.C. motor: Construction characteristics. Operating principles. Excitation systems. Armature reaction. Commutation. Speed control. Nameplate information. IV-2 Special machines: BLDC, Stepper Motors.

Planning			
	Class hours	Hours outside the classroom	Total hours

Problem solving	8	16	24
Laboratory practical	10	16	26
Lecturing	32.5	65	97.5
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
Problem solving	Student will be required to work in groups to solve and present some proposed ac machines problems. This activity could be done using the "virtual office" if presentiality is not posisible due to the COVID19 University self-quarantine polilcies
Laboratory practical	Typical lab session in the Electrical Machines laoratory. They can be done online (iusing some machine simulation software) if presentiality is not posisible due to the COVID19 University self-quarantine polilcies During these lessons students will apply the theoretical knowledge provided during the theory lessons, and at the same time they will learn how to protect themselves, other people and the machines against ANY possible electrical hazzard. Active and Passive Security will be taught and followed in these hours
Lecturing	Typical lecture. Either presential or using the "virtual office" facility. The place will depend on the COVID19 University self-quarantine polilcies

Personalized assistance

Methodologies	Description
Lecturing	Course-related discussions, asking for extra help, seeking clarification of material presented in class and following up on aspects of the class you find compelling can be done during the "Office Hours". They can be presential or "virtual". The student should ask the lecturer (e-mail) in order to decide the day and the time
Problem solving	Course-related discussions, asking for extra help, seeking clarification of material presented in class and following up on aspects of the class you find compelling can be done during the "Office Hours". They can be presential or "virtual". The student should ask the lecturer (e-mail) in order to decide the day and the time

Assessment

	Description	Qualification	Evaluated Competencess
Problem solving	The assessment method will be a numerical resolution of some exercises of electrical machines A minimum mark of 40% will be required in this part Part of this qualification percentage could be obtained with some continuous evaluation, depending on the lecturer. (5/40). Student will be properly informed if this option is activated.	40	
Lecturing	The assessment method will be a 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 Part of this qualification percentage could be obtained with some continuous evaluation in the lab lessons, depending on the lecturer. (10/60). Student will be properly informed if this option is activated.	60	

Other comments on the Evaluation

To pass the subject a minimum of 5/10 will be required (result of the sum of the 2 parts)

If the student final mark is bigger than 5, but the minimum in each part is not reached, the overall given mark will be 4.0 (FAILED)

Commitment: An student ethical behaviour is expected. If a non-ethical behaviour is detected (copying, cheating in any

way, using unlicensed electronic devices, and others), it will be considered that the student does not gather the necessary requirements to pass the subject. In case of some unethical behaviour the mark will be 0.0 (FAILED) The COVID19 University policies can modify the final exam type, if we have to move to a "virtual exam". Any change will be announced properly so the students can adapt their learning processes to the new situation

Sources of information

Basic Bibliography

Complementary Bibliography

B. Novo, **Class notes**,

Any ac machines book,

Recommendations

Subjects that are recommended to be taken simultaneously

Automation and control fundamentals/V12G363V01304

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G363V01102
Physics: Physics 2/V12G363V01202
Basics of circuit analysis and electrical machines/V12G363V01302
Applied electrotechnics/V12G363V01501

IDENTIFYING DATA				
Chemical technology				
Subject	Chemical technology			
Code	V12G363V01606			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	English			
Department				
Coordinator	Rosales Villanueva, Emilio			
Lecturers	Rosales Villanueva, Emilio Sanroman Braga, María Ángeles			
E-mail	emiliorv@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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 Problem solving.
CT9	CT9 Application of 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

ASSESSMENT: The participation of the student in any of the evaluation systems of the subject (laboratory practicals, problem solving and exercises) will imply that the student effectively take the subject and its qualification. A minimum attendance of 75% of the practices is required to have the right to the evaluation of the same. Otherwise, the mark for this section will be 0.0 and they will have to take an exam in the final exam.A student who "officially renounces continuous assessment", will fail if he/she does not achieve a MINIMUM mark of 4.0 points (out of 10) in each of the parts of the "FINAL EXAMINATION". If the minimum mark in the "FINAL EXAMINATION" is passed, the student will pass the course if the FINAL GRADE is ≥ 5.0, that is, if the sum of the marks obtained in the different systems of evaluation of the course is ≥ 5.0.
Second call: The same criteria will be applied in the second sitting. With regard to the July exam, the grade of the different assessment systems (laboratory practicals, problem solving and exercises) will be maintained, so students will only take the "FINAL EXAM"
STUDENTS RELEASED FROM CONTINUOUS ASSESSMENT: When the School releases a student from the continuous assessment process, his/her grade will be the sum of 90% of the mark obtained in the "FINAL EXAM" and 10% of the laboratory practicals mark.
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**, 7th, Prentice Hall International, 2004

Felder, R.M. and Rousseau, R.W., **Elementary principles of chemical processes**, 3rd, John Wiley & Sons, Inc., 2005

Chopey, N.P., **Handbook of Chemical Engineering Calculations**, 3rd, McGraw-Hill Companies, 2003

Fogler, H.S., **Elements of Chemical Reaction Engineering**, 5th, Prentice Hall International,

Levenspiel, O., **Chemical Reaction Engineering**, 3rd,

Coulson, J.M. and others, **Chemical Engineering vol. 1 and vol 2**, 5th, Butterworth-Heinemann, 2002

McCabe, W.L., Smith, J.C. and Harriott, P., **Unit operations of chemical engineering**, 5th, McGraw-Hill International Editions, 1993

Seader, J.D., Henley, E.J., Roper, D.K., **Separation process principles. Chemical and Biochemical Operations**, 3rd, John Wiley & Sons, Inc., 2011

Complementary Bibliography

Treybal, R.E., **Mass-transfer operations**, 3rd,

Ocón, J. y Tojo, G., **Problemas de Ingeniería Química**, 3rd,

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.

IDENTIFYING DATA				
Electronic instrumentation				
Subject	Electronic instrumentation			
Code	V12G363V01701			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	English			
Department				
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo			
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.			

Skills
Code

Learning outcomes	
Learning outcomes	Competences

Contents	
Topic	
Topic 1: Introduction to the Electronic Instrumentation	Electronic instrumentation in the context of the control of processes. Systems of measure and its characterization. Introduction to the industry 4.0. IIoT
Topic 2: Sensors	Definition, classification and study of the characteristics of operation. Criteria of selection.
Topic 3: Data Acquisition System (DAS or DAQ). Auxiliary circuits	Bridges of measure. Fixers of tension. Sources of current. Converters V/I and I/V. Linealización.
Topic 4: DAQ. Amplification and filtered of signals	Amplifiers of instrumentation, programmable amplifiers, amplifier of isolation. Types of filters. Technicians of implementation of active filters.
Topic 5: DAQ. Circuits of conversion and multiplexed	Conversion A/D and D/a, types and technical characteristics. Circuits of show and retention (S&H). Analog switches. Multiplexer analog.
Topic 6: Implementation of data acquisition systems	Basic structures. Criteria of election in function of the parameters of the system.
Topic 7: 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 8: Teams of electronic instrumentation	Classification, technical characteristics and connection of teams of instrumentation. Criteria of selection. Buses of instrumentation.
Topic 9. Introduction to the Electronics of Power	Structure of a system of Electronic Power. Devices of power. Types of converters of electrical energy. Methods of calculation of powers.
Topic 10: Systems of identification for the traceability and improvement of processes	Bar codes. RFID. NFC. Applications.
Laboratory practice 1. Circuits with operational amplifiers.	Study of basic settings with operational amplifiers, linear settings and no linear.
Laboratory practice 2. Introduction to Virtual instrumentation. LabVIEW.	Introduction to Virtual Instrumentatio. Flow of data of LabVIEW. Frontal panel and diagrams of blocks. Description of the main types of data and structures of LabView programming. DAQ cards NI6008.
Laboratory practice 3: Conversion voltage-current and current-voltage	Implementation of circuits of conversion with floating load based in operational amplifiers.

Laboratory practice 4: Data acquisition system for the measurement of temperature.	It will implement a system of acquisition of complete data for the conditioning of a sensor of temperature PT1000.
Final project	- Implementation of a circuit of conditioning for the measure of a physical variable and his back acquisition by means of DAQ card. - Implementation of a control system for a physical variable measurement, based on a microcontroller. - Implementation of systems of storage of the information. Relational databases. 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. Theacher will try participation 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 magistrates 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 tutoring.
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 concepts theory, laboratory practice or projects. Students will have the opportunity to attend tutorials personalized or in groups in the teacher's office at the time established for that purpose at the start of the course and that will be published on the course page
Mentored work	In the laboratory 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	
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.	30	
Essay questions exam	In the dates indicated by the calendar of examinations of the centre, will make the final proofs that will consist in questions of theory and problems of development.	40	
Objective questions exam	In the dates indicated by school and through continuous evaluation, will make the evaluation of short questions of test.	20	

Other comments on the Evaluation

The long answer tests and multiple choice tests will be carried out on the dates set by the center and will represent 60% of the final grade. The remaining 40% 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 60% of the grade, the remaining 40% 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, **Design with amplifiers operational analog integrated circuits**, 3ª edición, Mc Graw-Hill, 2013

Essick, John, **Hands-on introduction to LabVIEW for scientists and engineers**, 1, Oxford University Press, 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
Ramón Pallás Areny, **Analog Sinagl Processing**, John G. Webster, 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

IDENTIFYING DATA				
Technical Office				
Subject	Technical Office			
Code	V12G363V01702			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	English			
Department				
Coordinator	Cerqueiro Pequeño, Jorge			
Lecturers	Casal Guisande, Manuel Cerqueiro Pequeño, Jorge			
E-mail	jcerquei@uvigo.es			
Web	http://http://webs.uvigo.es/oficinatecnica			
General description	The aim pursued with this course is to guide the student in the acquisition of the knowledge and the skills needed to qualify him for the handling and application of the methodologies, techniques and tools oriented to the elaboration, organisation and management of projects and another technical documentation regularly used in Engineering Offices, in ways that prepare the student to make use of these skills to carry out similar activities in his future professional activity in the real world. In order to achieve that goal, the course uses a broad approach of the subjects in its contents, looking for the integration of the knowledge achieved along the student□s previous courses and its application through the methodology, organisation and management of several different modalities of technical works, as they constitute the true essence of the Engineer profession in the framework of his professional competences and fields of activity. This course promotes the development of its associated skills by means of using active and technical collaborative methodologies. In this way, the contents explained in theoretical classes are implemented and developed in the practical activities -oriented to the industrial reality of the profession-, thus assimilating the agile and precise use of the different rules of application and of the professional best practices established, while being supported by the new technologies to document, elaborate, manage and present the technical documentation that correspond to each particular case.			

Skills	
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 Problem solving.
CT3	CT3 Oral and written proficiency in the own language.
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 Application of knowledge.
CT10	CT10 Self learning and work.
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	
Skills for using information and communication systems in the industrial field.	CE18	CT3 CT5 CT6 CT9 CT10 CT17

Handling design methods, techniques and tools, and project organisation and management.	CG1 CG2	CE18	CT1 CT2 CT5 CT6 CT7 CT8 CT10 CT15 CT17 CT20
Skills for the elaboration of project documents and other similar technical documents.	CG1 CG2		CT1 CT3 CT5 CT6 CT7 CT9 CT14 CT15 CT17
Skills for the tecnical management and supervision of projects in the Industrial Engineering field.	CG2	CE18	CT1 CT2 CT3 CT5 CT6 CT7 CT8 CT9 CT14 CT16 CT17 CT20
Skills for appropriatelly communicating documents, procedures, and results in the Industrial Engineering field.			CT3 CT5 CT6 CT7 CT14 CT17 CT20

Contents	
Topic	
1. Introduction and presentation of the course.	1.1. Presentation. 1.2. Learning guide for the course. 1.3. Criteria and norms for the development of the course. 1.4. Relevant professional and legal aspects.
2. The Engineering Office.	2.1. Introduction to the Industrial Engineering Office. 2.2. Works of the Engineering Office. 2.3. Infrastructure of an Engineering Office. 2.4. Organisation and management of an Engineering Office. 2.5. Introduction to decision-making tools applied to the Project context.
3. Technical reports and similar works.	3.1. Technical reports. 3.2. Assessments, valuations and budgets. 3.3. Other similar technical works. 3.4. Criteria and norms for the elaboration and presentation of technical works.
4. The Project Methodology.	4.1. Introduction. 4.2. Theories about the Project. 4.3. Methodology of the Project process. 4.4. The phases of an industrial project.
5. The normative and legal frame of the Project.	5.1. The legal regulations and the Project. 5.2. Specific applicable technical norms. 5.3. Standardization, certification, homologation and quality aspects. 5.4. Industrial property: patent rights and transfer of technology.
6. Documents in Industrial Projects.	6.1. Report. 6.2. Plans. 6.3. Specifications. 6.4. Measurements and Budget. 6.5. Specific studies.

7. Methods and techniques for the organisation and management of Projects.	7.1. Organisation, supervision and coordination of Projects. 7.2. Methods and techniques for the management of Projects. 7.3. Techniques for the optimisation of Projects. 7.4. Tools for the computer-assisted management of Projects.
8. Processing of Projects and of another technical documentation.	8.1. Criteria and norms for the processing of Projects. 8.2. Process for the certification of Projects and other technical documents. 8.3. Management of licences, permissions and authorisations before public and private institutions. 8.4. Bidding and contracting of Projects.
9. Engineering Supervision of industrial projects.	9.1. Professionals that take part in the execution of projects. 9.2. Functions and activities of the Engineering or Work Supervision Office. 9.3. Legal frame that regulates the functions and responsibilities of the Engineering Supervision Office. 9.4. Obligations of the Engineering Supervision Office in matters of health and Security at work.
10. Presentation and Oral Defence of Technical Documents.	10.1. Oral presentations. 10.2. Preparation of presentations using electronic means. 10.3. Development of presentations through videoconference means.
Assignment 1. Elaboration of a technical report or similar work.	The students, either individually or in teams, will elaborate a technical report -or similar work- on a subject related with the industrial engineering field, starting from the information provided by the lecturer, and taking into account the indications received about the methodology to be used.
Assignment 2. Elaboration of a small project.	Organised the students in groups of three or four members, they will elaborate the necessary project documents to propose an efficient solution to a problem or need belonging to the Industrial Engineering field, following formal rigour and technician criteria.
Assignment 3. Development of a basic planning and scheduling proposal for the execution of an industrial project.	Each student on his own will elaborate a proposal for the time and resources planning and programming for the process of execution of an industrial project, using the appropriate methods and computer tools, and elaborating the required statistics report for the project.
Assignment 4. Public presentation of the developed work.	Final group presentation by each of the work teams on the results of all -or part of- the practical works developed in the course, addressed to the whole of the course student group.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	40	66
Project based learning	24	42	66
Design Thinking	0	6	6
Mentored work	0	6	6
Problem and/or exercise solving	4	0	4
Report of practices, practicum and external practices	0	2	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies

	Description
Lecturing	The theoretical contents will be presented by the lecturer, complemented with the active intervention of the students, and in total coordination with the development of the practical activities programmed.
Project based learning	Realisation of an interdisciplinary project resembling a real case with the students arranged in groups, requesting active participation of all members, and with the guidance of the lecturer.
Design Thinking	Development of design activities, by the student teams, of products related with the topics of the industrial engineering discipline, making use of the "Design Thinking" methodology. This encompasses an incremental approximation to the final product concept, by extensively emphathizing with the customer and their needs, and going through a number of intermediate mock-ups and models.
Mentored work	Elaboration under the supervision of the lecturer, either individually or in teams, of activities related with the contents of the course, starting from the provided initial information and following the procedures and methodologies recommended.

Personalized assistance

Methodologies	Description
Project based learning	Realisation of an interdisciplinary project resembling a real case with the students arranged in groups, requesting active participation of all members, and with the guidance of the lecturer.

Design Thinking	Development of design activities, by the student teams, of products related with the topics of the industrial engineering discipline, making use of the "Design Thinking" methodology. This encompasses an incremental approximation to the final product concept, by extensively emphathizing with the customer and their needs, and going through a number of intermediate mock-ups and models.
Mentored work	Elaboration under the supervision of the lecturer, either individually or in teams, of activities related with the contents of the course, starting from the provided initial information and following the procedures and methodologies recommended.

Assessment

	Description	Qualification	Evaluated Competencess		
Problem and/or exercise solving	A series of partial assessment tests will be carried out along the course, aiming to evaluate the knowledge acquired by the students on the main concepts explained in the theory classes. The length of the test will depend on the topics to be assessed with it.	35	CG1	CE18	CT1 CT5 CT6 CT8 CT14 CT15 CT16
Report of practices, practicum and external practices	A collection of written reports on the practical activities carried out will be elaborated by the students/student teams and delivered to the lecturer according to the established schedule. The commitment and implication of the students with the theory classes and the laboratory activities programmed will also be taken into account, as well as the meeting of the submission deadlines and the technical and format quality of the written works and the presentations.	65	CG1 CG2	CE18	CT1 CT2 CT3 CT5 CT6 CT7 CT8 CT9 CT10 CT14 CT15 CT17 CT20

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 grades 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, this last only after obtaining the appropriate clearance from the EEI's Direction. In both cases the grading of the course will be made according to a numerical system, using values from 0.0 to 10.0 points according to the current laws that are applicable (R.D. 1125/2003 of 5th September, BOE Nr. 224 of 18th September). A minimum overall mark of 5.0 is required to pass this course.

For the First Announcement or Edition.

a) 'Continuous Evaluation' modality:

The final grade 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 (65% weight) along the course, with the mark awarded for the final test performed in the date stated by the School's Ruling (35% weight).

Those 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 5.0 points out of 10.0 that are required for every section, they will either need to perform also the assessment in the Second Announcement date, or to elaborate additional works or practical exercises to achieve the learning goals that were established for the concerned sections.

b) 'Non-Continuous Evaluation' modality:

There is a two-week time period 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

the whole 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 grade for the course.

A minimum mark of 5.0 points out of 10.0 possible will be required to pass the course.

For the Second 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 of the 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 10.0 possible to pass the course.

Ethical commitment:

It is expected an appropriate 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 grade for the course in the current academic year will be a Fail (0.0).

Sources of information

Basic Bibliography

Alam, M. Daud; Gühl, Uwe F., **PROJECT-MANAGEMENT IN PRACTICE: A GUIDELINE AND TOOLBOX FOR SUCCESSFUL PROJECTS**, 1st, Springer, 2016

Brusola Simón, Fernando, **OFICINA TÉCNICA Y PROYECTOS**, 1st, Servicio Publicaciones Universidad Pol. Valencia, 2011

Gómez-Senent Martínez, Eliseo; González Cruz, Mª Carmen, **TEORÍA Y METODOLOGÍA DEL PROYECTO**, 1ª, Servicio Publicaciones Universidad Pol. Valencia, 2008

Kerzner, Harold, **PROJECT MANAGEMENT: CASE STUDIES**, 4th, John Wiley and Sons, 2013

Project Management Institute, **A GUIDE TO THE PROJECT MANAGEMENT BODY OF KNOWLEDGE (PMBOK® GUIDE)**, 6th, Project Management Institute, 2017

Serer Figueroa, Marcos, **GESTIÓN INTEGRADA DE PROYECTOS**, 3ª, Ediciones UPC, 2010

Complementary Bibliography

De Cos Castillo, Manuel, **TEORIA GENERAL DEL PROYECTO I: GESTIÓN DE PROYECTOS**, 4ª, Síntesis, 2007

De Cos Castillo, Manuel, **TEORIA GENERAL DEL PROYECTO II: INGENIERIA DE PROYECTOS**, 4ª, Síntesis, 2007

Díaz Martín, Ángel, **EL ARTE DE DIRIGIR PROYECTOS**, 3ª, RA-MA, D.L., 2010

Kerzner, Harold, **PROJECT MANAGEMENT 2.0: LEVERAGING TOOLS, DISTRIBUTED COLLABORATION, AND METRICS FOR PROJECT SUCCESS**, 1st, John Wiley and Sons, 2015

Kerzner, Harold, **PROJECT MANAGEMENT: A SYSTEMS APPROACH TO PLANNING, SCHEDULING, AND CONTROLLING**, 11th, John Wiley and Sons, 2013

Kuster, Jürg et al., **PROJECT MANAGEMENT HANDBOOK**, 1st, Springer, 2015

Lock, Dennis, **PROJECT MANAGEMENT**, 10th, Routledge, 2013

Martínez de Pisón Ascacíbar, Francisco Javier et al., **LA OFICINA TÉCNICA Y LOS PROYECTOS INDUSTRIALES**, 1ª, Asociación Española de Ingeniería de Proyectos, 2002

Santos Sabrás, Fernando, **INGENIERÍA DE PROYECTOS**, 2ª, Eunsa, 2002

Recommendations

Subjects that continue the syllabus

Final Year Dissertation/V12G380V01991

Subjects that it is recommended to have taken before

Graphic expression: Graphic expression/V12G380V01101

Other comments

To register for this course, the students are required to have passed, or at least are registered in, all the courses from previous years to the one this course is placed on. It is necessary to stress the importance of having passed the two courses indicated in the previous section before taking this course.

Previously to the realisation of the scheduled assesments, students should check in the MooVi platform to know whether it is necessary for them to carry any particular documentation, materials, etc. into the exam room to perform the tests.

In case there are any discrepancies, the version in English of this guide will prevail.

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G363V01703			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Álvarez da Costa, Estrella Cameselle Fernández, Claudio			
Lecturers	Álvarez da Costa, Estrella Cameselle Fernández, Claudio			
E-mail	ealvarez@uvigo.es claudio@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. This subject provides an approach to Environmental Engineering, which is necessary to develop any engineering project. In it we work areas of Chemistry and Process Engineering, in order to study the pollutants behaviour and their effect on the environment and organisms, to design physical-chemical processes to mitigate pollution, as well as to evaluate the environmental impact of the industrial wastes. The subject's objective is to know, understand, and know how to apply the techniques used, on an industrial scale, in fields such as solid wastes treatment and management, wastewater treatment, soil remediation, treatment of polluting gas industrial emissions, and pollution prevention. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Skills	
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 Problem solving.
CT3	CT3 Oral and written proficiency in the own language.
CT9	CT9 Application of knowledge.
CT10	CT10 Self learning and work.
CT12	CT12 Research skills.
CT17	CT17 Working as a team.
CT19	CT19 Personal relationships.

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. Municipal 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: Air pollution.	1. Types and origin of air pollutants. 2. Dispersion of pollutants in the atmosphere. 3. Effects of the air 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 carbon to be used as an adsorbent.	
Practice 3: Contaminants removal by adsorption with immobilized activated carbon.	
Practice 4: Coagulation-flocculation: definition of of optimal operating conditions.	
Practice 5: Simulation of the activated sludge process in a WWTP.	
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/V12G363V01102
Physics: Physics 2/V12G363V01202
Chemistry: Chemistry/V12G363V01205
Chemical technology/V12G363V01606

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.

IDENTIFYING DATA				
Thermal technology				
Subject	Thermal technology			
Code	V12G363V01704			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	English			
Department				
Coordinator	Gómez Rodríguez, Miguel Ángel			
Lecturers	Gómez Rodríguez, Miguel Ángel			
E-mail	miguelgr@uvigo.es			
Web				
General description	In this subject, it is expected that the student adquire the essential knowledges that allow them to understand the operation of the thermal machines and the processes that take place in their interior, as well as that know the main types of machines and installations and their components. This knowledge results basic for the analysis of the operation, design and construction of the thermal machines and of their thermal setups, and in general, the industrial applications of the thermal engineering. The subject is focused on energy efficiency as well as environmental and social aspects. These are applied to systems using thermal cycles: power cycles (gas and steam) and in refrigeration and heat pump cycles, as well as the use of different renewable fuels.			

Skills	
Code	
CG4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, 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.
CG7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
CG11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
CE7	CE7 Knowledge of applied thermodynamics and heat transfer. Basic principles and their application to solving engineering problems.
CT2	CT2 Problem solving.
CT7	CT7 Ability to organize and plan.
CT9	CT9 Application of 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	Competences		
Learning outcomes			
Ability to know, understand, use and design energy systems by applying the principles and fundamentals of thermodynamics and thermostatic and fundamentals of thermodynamics and energy transmission.	CG4 CG5	CE7	CT2 CT9
Understanding the fundamentals of combustion	CG4 CG5 CG7	CE7	CT2 CT7 CT9
Understanding the fundamentals of heat engines	CG4 CG5 CG7	CE7	CT2 CT7 CT9
Understanding the fundamentals of a thermal power plant operation	CG4 CG5 CG6 CG11	CE7	CT2 CT9 CT10 CT17 CT20

Contents
Topic

INTRODUCTION	1. Energy issues. Society and energy use 2. Energy production and consumption
HEAT EXCHANGERS	1. Classification of the heat exchangers 2. Calculation of the main parameters 3. Dimensioning 4. Method of the mean logarithmic temperature 5. Method E-NTU
COMBUSTION	1. Introduction 2. Types of combustion 3. Minimum or theoretical air 4. Excess combustion air 5. Combustion fumes 6. Incomplete combustion 7. Combustion diagrams 8. Combustion efficiency
HUMID AIR	1. Introduction 2. Moisture indices 3. Enthalpy of moist air 4. Dew point 5. Adiabatic saturation temperature 6. Wet bulb temperature 7. Psychrometric: Moist air diagrams 8. Mixing of two or more humid airs 9. Mixing of an air mass with water, steam and/or heat 10. Air conditioning processes
THERMAL MACHINES	1. Thermal machines. General 2. Rankine cycle 3. Rankine cycle with regeneration 4. Gas turbines 5. Burners 6. Boilers: definition and typology 7. Energy efficiency 8. Design of heat and water systems in buildings
POWER PLANTS TECHNOLOGY	1. Steam thermal power plant technology 2. Combined cycle power plant technology 3. Nuclear power plant technology 4. Cogeneration
AIR-CONDITIONING INSTALLATIONS	1. Introduction 2. Refrigeration cycle 3. Heat pump 4. Heat pump components 5. Operating characteristics 6. Design of air-conditioning systems 7. Energy efficiency
INTRODUCTION TO THERMAL ENGINES	1. Classification of internal combustion engines 2. Operation of reciprocating internal combustion engines 3. Parts of reciprocating internal combustion engines 4. Nomenclature and basic parameters 5. Theoretical cycles 6. Real cycles

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	21	41
Laboratory practical	4.5	0	4.5
Problem solving	8	14.5	22.5
Practices through ICT	2	0	2
Studies excursion	9	0	9
Mentored work	3	64	67
Problem and/or exercise solving	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	Classical lectures on the blackboard supported by slides, videos and any other material that the lecturer considers useful to make the any material that the teacher considers useful to make the subject matter of the course understandable
Laboratory practical	Performance of applied laboratory practices. The activities will consist of disassembling thermal engines, measuring thermal engines, measurement of emissions...
Problem solving	Exercises solving and case studies necessary for the preparation of theory classes
Practices through ICT	Solving exercises with the support of computer programmes
Studies excursion	Visits to installations to learn about the industrial level equipment explained in the lectures
Mentored work	Individual and/or group supervised work. This activity includes the presentation presentation of this work to the group and its subsequent evaluation

Personalized assistance

Methodologies	Description
Lecturing	Doubts statement during tutorial hours. The student will raise, during the time dedicated to to the tutorials, the doubts concerning the contents developed in the subject, and/or exercises or problems that arise concerning the application of the contents.
Laboratory practical	Raising doubts during practice hours. The student will raise, during the time dedicated to the doubts related to the concepts and development of the aforementioned practical sessions
Problem solving	Raising doubts during tutorial hours. The student will raise, during the time dedicated to tutorials, the doubts concerning the contents that are developed in the subject, and/or exercises or problems that arise relating to the application of the contents
Mentored work	The student will raise doubts during tutorials or in the classes dedicated to the preparation of the work regarding its preparation and the preparation and development of the work

Tests	Description
Problem and/or exercise solving	
Essay questions exam	

Assessment

	Description	Qualification	Evaluated Competencess		
Mentored work	Delivery of the reports of the work carried out and oral presentation of the same. Resolution of problems raised during the course.	10	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20
Problem and/or exercise solving	Partial exams taken along the course during class hours.	20	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20
Essay questions exam	Final exam that will collect all the contents taught during the course. The exam will consist of problem solving and questions where both theoretical and practical content will be evaluated.	70	CG4 CG5 CG6 CG7 CG11	CE7	CT2 CT7 CT9 CT10 CT17 CT20

Other comments on the Evaluation

Ethical commitment: The learner is expected to display appropriate ethical behaviour. If unethical behaviour (copying, plagiarism, unauthorised unethical behaviour (copying, plagiarism, unauthorised use of electronic devices, etc.), the student is considered to be ineligible to pass the course. student does not meet the necessary requirements to pass the subject. In this case the overall grade for the current academic year will be a fail (0.0). academic year will be a fail (0.0). The use of any electronic device will not be allowed during the assessment tests unless expressly.

evaluation tests unless expressly authorised. Bringing an unauthorised electronic device into the exam room will be considered as a reason for failing the exam. will be considered as a reason for not passing the subject in the current academic year and the overall grade will be a fail (0.0).

Sources of information

Basic Bibliography

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

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

Moran M.J.; Shapiro H.N., **Fundamentals of thermodynamics**, 8th ed. Wiley,

Incropera, F.P. et al, **Principles of heat and mass transfer**, 7th ed., international student version, Hoboken, N.J. : John Wiley,,

Complementary Bibliography

Heywood, J.B., **Internal combustion engines fundamentals**, McGraw-Hill,

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
Thermodynamics and heat transfer/V12G360V01405

IDENTIFYING DATA				
Electrical systems				
Subject	Electrical systems			
Code	V12G363V01705			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language				
Department				
Coordinator	Villanueva Torres, Daniel			
Lecturers	Villanueva Torres, Daniel			
E-mail	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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
CE21	CE21 Knowledge of electric systems of power and their applications
CT2	CT2 Problem solving.
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

IDENTIFYING DATA				
Control e automatización industrial				
Subject	Control e automatización industrial			
Code	V12G363V01801			
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.

IDENTIFYING DATA				
Fundamentos de administración de empresas				
Subject	Fundamentos de administración de empresas			
Code	V12G363V01802			
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	O obxectivo desta materia é dar a coñecer os aspectos fundamentais da función de administración da empresa, incidindo na importancia do sistema de información económico-financeiro para analizar a situación patrimonial e competitiva da empresa, de maneira que sirva de apoio á toma de decisións empresariais.			

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
TEMA 2	A PLANIFICACIÓN E O CONTROL
TEMA 3	A ORGANIZACIÓN E A DIRECCIÓN DE PERSOAS
TEMA 4	A TOMA DE DECISIÓNS NA EMPRESA
TEMA 5	A INFORMACIÓN CORPORATIVA
TEMA 6	A ANÁLISE ECONÓMICA E FINANCEIRA
TEMA 7	A EVOLUCIÓN DA EMPRESA

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 na materia. Ésta consta dos seguintes elementos:

- **Proba de avaliación intermedia**. Esta proba será tipo test, desenvolverase no horario do bloque de teoría, nunha data establecida ao comezo da docencia, e o seu contido será teórico e práctico. Ésta suporá o **20% da cualificación final** da materia. Esta proba non é recuperable, e 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. Cada práctica realizada por o/a alumno/a será avaliada, sendo a cualificación total de prácticas, a media aritmética das notas obtidas nestas. As prácticas non son recuperables, polo tanto, se non se asiste a unha práctica, a nota nesa práctica será cero.
- **Exame final**. O exame que se desenvolverá na data oficial marcada 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 superar a materia. Este exame consta de dúas partes, unha parte de teoría que será tipo test e unha parte práctica que incluirá unha serie de exercicios para desenvolver.

2. AVALIACIÓN NON CONTINUA

No caso dos/das alumnos/as que renuncien expresamente á avaliación continua, realizarase un único exame na data oficial marcada na planificación docente do curso. Este exame dará a posibilidade de obter o 100% da cualificación. Este exame constará de dúas partes, unha parte de teoría que será tipo test e unha parte práctica que incluirá unha serie de exercicios para desenvolver. IMPORTANTE: É condición necesaria, aínda que non suficiente, para superar a materia, obter na parte de teoría unha puntuación mínima de 5, nunha escala do 0 a 10.

3. RECUPERACIÓN DE XULLO

O exame de recuperación de xullo será similar ao exame final. Os/as alumnos/as que optaran pola avaliación continua poderán elexir que a cualificación na materia sexa o 100% da puntuación obtida neste exame. Para iso, o/a alumno/a deberá comunicarllo á profesora polo menos cunha semana de antelación ao exame.

4. COMPROMISO ÉTICO

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

Bibliografía. Fontes de información

Basic Bibliography

Weihrich, M. et al., **ADMINISTRACIÓN**, McGraw Hill, 2022

Moyano Fuentes, J. et al., **ADMINISTRACIÓN DE EMPRESAS. UN ENFOQUE TEÓRICO-PRÁCTICO**, Prentice Hall, 2011

Iborra Juan, M. et al., **FUNDAMENTOS DE DIRECCIÓN DE EMPRESAS**, Thomson, 2007

Complementary Bibliography

Cuervo García, A., **INTRODUCCION A LA ADMINISTRACION DE EMPRESAS**, Civitas, 2008

Bueno Campos, E., **CURSO BÁSICO DE ECONOMÍA DE LA EMPRESA. UN ENFOQUE ORGANIZATIVO**, 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.

IDENTIFYING DATA				
Compoñentes eléctricos en vehículos				
Subject	Compoñentes eléctricos en vehículos			
Code	V12G363V01902			
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 na lingua propia.
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**, 0415725771, Fifth Edition, Taylor & Francis Ltd, 2017

Eli Emadi, **Advanced Electric Drive Vehicles**, 2015, CRC Press Taylor & Francis Group,

Bosch, **Automotive Handbook**, 8th Edition

Johneric LEACH, **Automotive 48-volt Technology**, 978-0-7680-8318-7, ‎ SAE International, 2016

K. T. Chau, **ELECTRIC VEHICLE MACHINES AND DRIVES DESIGN, ANALYSIS AND APPLICATION**, 2015, Wiley,

Kevin Jost, **48-Volt Developments**, 978-0768081923, SAE International, 2015

William B. Ribbens, **Understanding Automotive Electronics. An Engineering Perspective**, Elsevier Inc., 2017

Complementary Bibliography

Sánchez Fernández, Enrique, **Circuitos Eléctricos Auxiliares del Vehículo**, 2012,

Bruno Scrosati, J. Garche, W. Tillmetz, **Advances in Battery Technologies for Electric Vehicles**, Elsevier Ltd., 2015

Nicolas Navet, F. Simonot-Lion, **Automotive Embedded Systems Handbook**, CRC Press Taylor & Francis Group, 2009

Esteban José Domínguez y Julián Ferrer, **Circuitos eléctricos auxiliares del vehículo**, 2012,

José Domínguez, Esteban, **Sistemas de Carga y arranque**, 2011,

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.

IDENTIFYING DATA				
Technical english 1				
Subject	Technical english 1			
Code	V12G363V01903			
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	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.			

Skills	
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	
UNIT 1: NUMBERS AND TRENDS	Skills - Writing, reading, and presenting facts and numbers correctly in a professional setting. - Understanding symbols and abbreviations. - Presenting data: Interpreting and describing graphs, charts, and diagrams. Language - Expressing numbers and calculations. - Expressing measurement and technical specifications. - Saying temperatures. - Saying dates, websites and email addresses. - Language for talking about trends. - Adjectives and adverbs. - Prepositions. - Describing timelines.
UNIT 2: DESIGN AND INNOVATION: DESCRIBING PRODUCTS AND TECHNOLOGIES	Skills - Describing uses, appearance, and definitions. - Giving a short presentation: Structuring a presentation, exploring effective presentation strategies. Language - Language of description (e.g., It’s really + adj./ It can + verb/ It looks like, it is shaped like /It is in the shape of …); defining relative clauses, reduced relative clauses. - Adjectives and qualities, order of adjectives. - Comparing and contrasting; superlative adjectives. - Nouns and adjectives connected with geometry and properties. - Reason and purpose - Conditionals. - Language for presenting: Key words and phrases for introducing, and concluding your presentation, signposting language for linking ideas; language for dealing with questions; persuasive language.
UNIT 3: GIVING INSTRUCTIONS AND DESCRIBING A MANUFACTURING PROCESS	Skills - Describing a process; explaining a process using a diagram; discussing the stages of production. - Writing clear instructions and warnings. Language - The Passive Voice: present simple passive structures. - Verbs for manufacturing operations. - Imperatives for instructions and warnings. - Language for sequencing instructions and processes (sequence words). - Adverbials of time (once, while, before and after) - Prepositions.
4. INSPECTION AND QUALITY CONTROL: REPORT WRITING	Skills - Writing a short report: general guidelines (structure, format, and style). - Writing a short report about a problem. Language - Possibility and Probability - Past simple and Present Perfect. - Time expressions.

5. JOB SEARCH: PREPARING FOR A JOB INTERVIEW	Skills - Identifying your personal strengths, key skills and experience. - Writing a short CV. - Talking about your CV. - Writing a cover letter. - Preparing a job interview: asking and answering interview questions. - Learning strategies to build applicant's confidence. Language - Phrases for demonstrating personal strengths and weaknesses. - Phrases to give details of your personal characteristics, qualifications, transferable skills, professional experience, etc. - Action verbs; positive adjectives, positive expressions. - Softening negative information and highlighting positive information. - Avoiding spelling mistakes. - Revision of past form of verbs, and prepositions. - Useful language for opening, main body and closing cover letters.

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

Particular considerations

There are two assessment systems: continuous or final. The selection of a system excludes the other.

1.1. Continuous assessment

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 assignments 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 must be delivered or submitted by the deadlines and dates set in advance.

1.2. Final assessment (non-attendants)

Students choosing the final examination will have to take a final overall test 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.

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.

To pass the course through continuous assessment, it is necessary to obtain an average grade of 5 points with a minimum of 4 (out of 10) in each of the parts. If this is not the case, the final average grade of the subject will be truncated with a maximum grade of 4.5 (out of 10), even if the arithmetic average of the tests is higher.

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 passed 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.

Continuous assessment will consider not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

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 (non-attendants)

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.

To pass the course, it is necessary to obtain an average grade of 5 points with a minimum of 4 (out of 10) in each of the parts. If this is not the case, the final average grade of the subject will be truncated with a maximum grade of 4.5 (out of 10), even if the arithmetic average of the tests is higher.

Regarding July's test, to completely pass the course, final assessment students who obtained a mark below 4 in any of the parts on the first edition of records will have to resit the exam of the whole course in future calls, including all the skills and linguistic contents of the subject.

Final assessment will consider not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

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.

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 MooVi and/or their emails, 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 MooVi, 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 requirements to pass the subject. In this case, the overall grade in the current academic year will be 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.

IDENTIFYING DATA				
Technical english 2				
Subject	Technical english 2			
Code	V12G363V01904			
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.			

Skills	
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 Application of 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. Facts and figures: Presenting data	UNIT 1 Skills - Writing, reading, and presenting facts and figures in a professional setting. - Understanding symbols and abbreviations. - Describing dimensions and specifications; phrases related to length, width, thickness, etc. - Describing and referring to visual aids. - Locating required information in a table of technical data. Language focus - Expressing facts and figures (mathematical symbols, dates, amounts, internet symbols and abbreviations). - Phrases for approximating numbers; saying results. - Talking about trends. - Vocabulary for describing trends. - Prepositions. - Cause-effect verbs. - Describing timelines: past simple, present perfect, past perfect and past perfect continuous, present continuous, will.
UNIT 2. Professional Presentations: Presenting with Impact	UNIT 2 Skills - Delivering impactful presentations. - Structuring a presentation. - Illustrating the importance of body language and voice power to communicate your message clearly and persuasively. Language focus - Presentation language: Language for introducing your presentation; language for focusing and emphasizing key points; language for in recapping. - Using persuasive language to create impact. - Signposting language for linking the parts.
UNIT 3. Technical Descriptions	SKills - Understanding and describing process diagrams, phases and procedures. - Describing technical functions and applications and explaining how technology works - Describing specific materials; categorising materials and specifying and describing properties - Describing component shapes and features; explaining manufacturing techniques - Describing health and safety precautions and emphasising the importance of precautions. Language focus - Verbs for describing stages of a process. - The passive form: Present simple passive structures. - Time Connectors. - Verbs for describing movement; verbs and adjectives to describe advantages; adverbs for adding emphasis. - Cause-effect (lead to, result in, etc.) - Negative prefixes (in-, un-, dis-, etc.). - Relative clauses: Defining vs non-defining relative clauses; shortened relative clauses. - Mixed conditionals, first vs. second conditional. - Would/ Could - Words for describing mechanisms, machining, properties of materials.

UNIT 4. Applying for a Job	Skills - Doing a self-evaluation of your strengths and weaknesses. - Writing different types of CV. - Becoming acquainted with cover and application letters. - Preparing for job interviews. - Demonstrating the best body language for job interviews. Language focus - Phrases for demonstrating strengths and weaknesses. - Useful language for talking about yourself, and demonstrating your skills and experience. - Action verbs; positive adjectives, positive expressions. - Softening negatives and turning negatives into positives. - Avoiding spelling mistakes. - Phrases for opening and closing a letter of application.
UNIT 5. Writing Emails	Skills - Writing short emails with appropriate formatting. - Recognizing and producing formal and informal language in emails. - Making your writing structured; writing effective openings and closings - Handling style, tone and voice. Language focus - Common email expressions. - Writing style. - Creating a warm, professional tone. - Avoiding spelling mistakes.

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

Particular considerations

There are two assessment systems: continuous or final. The selection of a system excludes the other.

1.1. Continuous assessment

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 assignments 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 must be delivered or submitted by the deadlines and dates set in advance.

1.2. Final assessment (non-attendants)

Students choosing the final examination will have to take a final overall test 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.

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.

To pass the course through continuous assessment, it is necessary to obtain an average grade of 5 points with a minimum of 4 (out of 10) in each of the parts. If this is not the case, the final average grade of the subject will be truncated with a maximum grade of 4.5 (out of 10), even if the arithmetic average of the tests is higher.

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 passed 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.

Continuous assessment will consider not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

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 (non-attendants)

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.

To pass the course, it is necessary to obtain an average grade of 5 points with a minimum of 4 (out of 10) in each of the parts. If this is not the case, the final average grade of the subject will be truncated with a maximum grade of 4.5 (out of 10), even if the arithmetic average of the tests is higher.

Regarding July's test, to completely pass the course, final assessment students who obtained a mark below 4 in any of the parts on the first edition of records will have to resit the exam of the whole course in future calls, including all the skills and linguistic contents of the subject.

Final assessment will consider not only the relevance and appropriateness of the content of the answers, but also their linguistic correctness.

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.

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 MooVi and/or their emails, 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 MooVi, 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 requirements to pass the subject. In this case, the overall grade in the current academic year will be 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.

IDENTIFYING DATA				
Methodology for the preparation, presentation and management of technical projects				
Subject	Methodology for the preparation, presentation and management of technical projects			
Code	V12G363V01905			
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	Alonso Rodríguez, José Antonio Cerqueiro Pequeño, Jorge			
Lecturers	Alonso Rodríguez, José Antonio Cerqueiro Pequeño, Jorge González Cespón, José Luis			
E-mail	jcerquei@uvigo.es jaalonso@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.			

Skills	
Code	
CG3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and 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 Problem solving.
CT3	CT3 Oral and written proficiency in the own language.
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 Application of knowledge.
CT10	CT10 Self learning and work.
CT11	CT11 Planning changes to improve overall systems.
CT13	CT13 Adaptability to new situations.
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.

IDENTIFYING DATA				
Programación avanzada para a enxeñaría				
Subject	Programación avanzada para a enxeñaría			
Code	V12G363V01906			
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			
Lecturers	Camaño Portela, José Luís López Fernández, Joaquín			
E-mail	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

IDENTIFYING DATA				
Seguridade e hixiene industrial				
Subject	Seguridade e hixiene industrial			
Code	V12G363V01907			
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.

IDENTIFYING DATA				
Laser technology				
Subject	Laser technology			
Code	V12G363V01908			
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	Boutinguiza Larosi, Mohamed 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.			

Skills	
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.

IDENTIFYING DATA				
Internships: Internships in companies				
Subject	Internships: Internships in companies			
Code	V12G363V01981			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo			
E-mail	eguizaba@uvigo.es			

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

IDENTIFYING DATA				
Traballo de Fin de Grao				
Subject	Traballo de Fin de Grao			
Code	V12G363V01991			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Deseño na enxeñaría Física aplicada			
Coordinator	Cerqueiro Pequeño, Jorge Trillo Yáñez, María Cristina			
Lecturers	Cerqueiro Pequeño, Jorge Trillo Yáñez, María Cristina			
E-mail	jcerquei@uvigo.es mctrillo@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 Adaptación a novas situacións.

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.

IDENTIFYING DATA				
Prácticas en empresa/asignatura optativa				
Subject	Prácticas en empresa/asignatura optativa			
Code	V12G363V01999			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Tecnoloxía electrónica			
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo			
E-mail	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