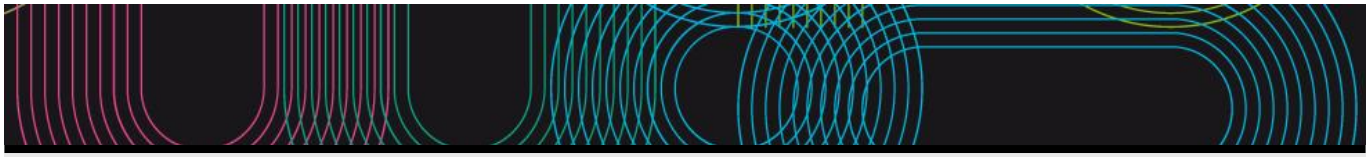

(*)Escola de Enxeñaría Industrial

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	Choose	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	González Cespón, José Luis			
Lecturers	Alonso Rodríguez, José Antonio Díaz Vilariño, Lucía Fernández Álvarez, Antonio González Cespón, José Luis López Saiz, Esteban Patiño Barbeito, Faustino Prado Cerqueira, José Luís Villar García, Marcos			
E-mail	epi@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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
C5	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.
D2	CT2 Problem solving.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.

Expected results from this subject	Training and Learning Results		
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.	B3 B4	C5	D6
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.	B3 B4	C5	D2
Use new technologies to develop graphic communication skills, including the creation and interpretation of engineering drawings which are compliant with the Technical Drawing Standards.	B6	C5	D6 D9
Adopt a positive attitude towards lifelong learning, being proactive, participative and with a spirit of self-improvement.	B4		D9

Contents	
Topic	
(*)Bloque I Xeometría plana.	(*)Repaso de coñecementos previos. Xeometría métrica aplicada á enxeñaría. Curvas técnicas.

(*)Bloque II Debuxo asistido por ordenador en 2D y 3D.	(*)Introdución ao debuxo asistido por ordenador. CAD. Entorno de traballo. Sistemas de coordenadas. Intercambio UCS-UCS. UCSFOLLOW. ADMINSCP. Comandos de debuxo. Entidades gráficas. Axudas para o debuxo. Referencias de entidades. Elementos básicos - Comandos de edición, repetición, ferramentas de expresión: capas e sombreado. Comandos de visualización, presentación, acotación e impresión. Entornos 3D: operacións básicas, modelado, conxuntos e debuxos. Intercambio de información.
(*)Bloque III. Sistemas de representación.	(*)Fundamentos. Introdución: Tipos de proxeccións. Invariantes proxectivos. Sistema diédrico. Fundamentos. Pertenza e incidencia. Paralelismo e perpendicularidade. Distancias e ángulos. Operacións: Rotacións, cambios de plano e diminucións. Superficies radiadas e poliedros de revolución. Sistemas de planos limitados. Fundamentos. Pertenza e incidencia. Paralelismo e perpendicularidade. Distancias e ángulos. Dexeccións. Pertenza e incidencia. Paralelismo e perpendicularidade. Distancias e ángulos. Operacións: Rotacións, cambios de plano e diminucións. Sistema axonométrico: Fundamentos. Tipos de axonometría: trimétrica, dimétrica e isométrica. Sistema de perspectiva Cavalier: Fundamentos. Sistema de perspectiva cónica: Fundamentos.
(*)Bloque IV. Normalización.	(*)O Debuxo como linguaxe. Tipos. Normalización de debuxos de bosquexo e aplicación de normas. Normalización do debuxo. Normalización básica: formatos, escritura, tipos de liña, escalas, etc. Representación segundo a ISO 128. Principios básicos de representación. Métodos de proxección. Vistas. Seccións, cortes e roturas. Convencionalismos. Norma de dimensionamento ISO 129. Principios xerais de dimensionamento. Dimensionamento de mecanizado: roscas e conexións roscadas. Clasificación de roscas. Representación de roscas. Roscas estandarizadas. Designación e dimensións das roscas máis comúns (M e W). Debuxos de montaxe e explosionados. Sistema de tolerancias. Tolerancias dimensionais e axustes. Tolerancias ISO: graos, posicións, tipos de axuste, etc. Sistemas de axuste. Implementación en debuxos. Exemplos.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	38	76	114
Problem solving	34	15	49
Seminars	3.5	0	3.5
Project based learning	0	22	22
Problem and/or exercise solving	3	0	3
Problem and/or exercise solving	3	0	3
Laboratory practice	1	10	11
Laboratory practice	3.5	16	19.5

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

Methodologies

	Description
Lecturing	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	Training and Learning Results		
Problem and/or exercise solving	It will make a first partial examination (eliminatory of matter) of the first contents of the matter, that will be able to include test type test, questions of reasoning, resolution of problems and development of practical cases. It demands reach a minimum qualification of 4,0 points on 10 possible to be able to surpass the subject.	35	B3 B6	C5	D2 D9
Problem and/or exercise solving	It will make a second partial examination (eliminatory of matter) of the remaining contents of the matter, that will be able to include test type test, questions of reasoning, resolution of problems and development of practical cases. It demands reach a minimum qualification of 4,0 points on 10 possible to be able to surpass the subject.	35	B4 B6	C5	D2 D9
Laboratory practice	It will make a proof of practise of CAD, in which it will verify the capacity of the student in the handle of systems of drawing by computer. It demands reach a minimum qualification of 5,0 points on 10 possible to be able to surpass the subject	15	B4	C5	D2 D6 D9
Laboratory practice	Along the course, in determinate sessions will pose problems or exercises for his resolution by the students and back delivery to the professor, that will evaluate them in accordance with the criteria that previously will have communicated to the students. These tasks will be so much in format paper as of CAD. It demands reach a minimum qualification of 5,0 points on 10 possible to be able to surpass the subject.	15	B4	C5	D2 D6 D9

Other comments on the Evaluation

MODALITY OF CONTINUOUS EVALUATION:

There will be two eliminatory partial tests (with an approximate weight of 25% and 35%) in which a minimum mark of 4.0 out of a possible 10 points must be obtained in each of the tests (as well as an overall 5.0) in order to pass the subject. The parts not passed can be passed later in the final exam of the subject.

In addition to the two partial tests, the practical work will also be assessed by means of a CAD test and the different sheet, exercises and practical work that will be carried out throughout the whole four-month period (with a weight of 20% and 20% respectively for each of these two parts). In order to pass the subject, a minimum mark of 5.0/10 points must be achieved in each of these parts.

In the final exam, a theoretical-practical test will be carried out to assess the degree of acquisition of competences, in which a minimum grade of 5.0/10 will be required to pass the course.

In the second call, there will be a theoretical-practical test in order to pass the course, it will be necessary to achieve a minimum grade of 5.0/10. This exam is open to all students who have not passed the subject in any of the previous tests.

MODALITY OF NON CONTINUOUS EVALUATION:

Students who waive continuous assessment must sit the final exam with all the material and must also take a practical test in order to pass the subject. This practical test, which will complete the overall final exam, will consist of two parts, one of CAD and the other of graphic tracings (in addition, in order to take this practical test, students may be required to present a series of tasks previously carried out by the student).

In the second call, there will be a theoretical-practical test with similar characteristics to the final exam, in which, in order to pass the course, it will be necessary to achieve a minimum grade of 5.0/10. This exam is open to all students who have not passed the subject in any of the previous tests.

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

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Giesecke, Mitchell, Spencer, Hill, Dygdon, Novak, Lockhart, **Technical Drawing with Engineering Graphics,**, 14ª, Prentice Hall, 2012

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

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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,

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

González García,V.; López Poza, R.; Nieto Oñate, M., **Sistemas de Represntación I**,

Bertoline, Wiebe, Miller, Mohler, **Dibujo en Ingeniería y Comunicación Gráfica**, 2ª, McGraw-Hill, 1999

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	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Lusquiños Rodríguez, Fernando			
Lecturers	Blanco García, Jesús Boutinguiza Larosi, Mohamed Domínguez Alonso, José Manuel Fernández Fernández, José Luís Lusquiños Rodríguez, Fernando Román Freijeiro, Claudia Sánchez Carnero, Noela Belén Trillo Yáñez, María Cristina Varela Benvenuto, Ramiro Alberto Vázquez Besteiro, Lucas			
E-mail	flusqui@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Physics course for 1st year bachelor degrees			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C2	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.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
To understand the basic concepts of the general laws of mechanics, and fields and waves.	B3	C2	
To be familiar with the basic instrumentation to measure physical quantities.		C2	
To know the basic techniques for the analysis and evaluation of experimental data.	B3	C2	D9 D10
To develop practical solutions to elementary technical engineering problems in the areas of mechanics and fields and waves.	B3	C2	D2 D9 D10

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	Training and Learning Results
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	B3 C2
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.	50	B3 C2 D2
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.	30	B3 C2
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	B3 C2 D9 D10

Other comments on the Evaluation

Final mark G comprises the marks on the topics covered in the lectures (classtest mark, weight 80%) and in the lab (laboratory mark, weight 20%).

1.1. CLASS TEST MARK It will be obtained through two blocks of theoretical-practical tests,which we will refer to with the letters C (course) and F (final), each with aweight of 40% of G. In the ordinary call, tests during the course (mark C0) and a final test(mark F1) will be taken. On the same day as the F1 test there will be anoptional test C1 to replace C0, so that each student can choose betweenmaintaining her/his mark C0 or taking the test to obtain a new mark C1 toreplace C0. The extraordinary call will comprise two tests, C2 and F2, equivalent incontents and assessment methodology (objective questions, essay questions and problemsolving) to C1 and F1, respectively. In test C2, each student can choosebetween maintaining her/his previous mark from block C or taking the test toobtain a new mark to replace the previous one. In test F2, each student canchoose between maintaining her/his previous mark from block F or taking thetest to obtain a new mark to replace the previous one. 1.2. LABORATORY MARK In the ordinary call, during the course you can obtain mark L0. Thismark consists of two blocks, each with a weight of 10% of G:theoretical-practical tests (mark L0E), and practical reports (mark L0I): L0 =L0E + L0I. It is mandatory the attendance to all labsessions to obtain the mark L0, otherwise, L0 = 0.0. On the same day as the F1 test there will be an optionaltheoretical-practical test L1 to replace L0, so that each student can choosebetween maintaining her/his previous mark L0 or taking the test to obtain a new mark L1 to replace L0. In the extraordinary call there will be a theoretical-practicaltest L2, equivalent in contents and assessmentmethodology to L1. In test L2, each student can choose between maintaining her/hisprevious laboratory mark or taking the test to obtain a new mark to replace theprevious one. 1.3. FINAL MARK G = C (40%) + F (40%) +L (20%) where C is the most recent of the C block marks, F is the most recent ofthe F block marks, and L is the most recent of the laboratory marks. 2. GLOBAL ASSESSMENT (EG) Only those students who have been granted a waiver of continuousassessment can opt for this assessment modality.

Final mark G comprises the marks on the topics covered in the lectures (classtest mark, weight 80%) and in the lab (laboratory mark, weight 20%).

2.1. CLASS TEST MARK It will be obtained through a theoretical-practical test (mark denotedby A1 in the ordinary call and by A2 in the extraordinary call). In test A2,each student can choose between maintaining her/his previous class test mark ortaking the test to obtain a new mark to replace the previous one. 2.2. LABORATORY MARK It will be obtained through a theoretical-practical test (mark denotedby L1 in the ordinary call and by L2 in the extraordinary call). In test L2,each student can choose between maintaining her/his previous laboratory mark or taking the test to obtaina new mark to replace the previous one. 2.3. FINAL MARK G = A (80%) + L (20%) where A is the most recent of the classtest marks, and L is the most recent of the laboratorymarks. 3. END-OF-PROGRAM CALL The end-of-program call follows the same scheme as the global assessment,with the exception that there is only one exam. Final mark G for the end-of-program call: G = A (80%) + L (20%). 4. GENERAL RULES To pass the course, a student must obtain a final mark equal to orhigher than 5 (out of 10). Students who do not take any of the tests (C, F, A, L) on the day of thefinal test will receive a grade of "no presentado" for that call. Within the specifications detailed in the preceding sections, the testsmay consist of different variants within the same classroom or laboratorygroup. Ethicalcommitment: Every student is expected to behave in an appropriate ethical manner.Should unethical conduct be detected (copying, plagiarism, utilisation ofunauthorised electronic devices, or others), the student will be considered notto have fulfilled the necessary requirements to pass the subject. In this case,the final mark

in the corresponding edition of the academic record for thesubject will be suspenso (0.0). Studentsshould not have access to or use any electronic device during the tests andexams, unless specifically authorised. The mere fact of taking an unauthorisedelectronic device into the examination room will result in the student failingthe subject and the final mark in the corresponding edition of the academicrecord for the subject will be suspenso (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	Choose	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Luaces Pazos, Ricardo			
Lecturers	Bazarra García, Noelia Castejón Lafuente, Alberto Elias Fiestras Janeiro, Gloria Gómez Rúa, María Luaces Pazos, Ricardo Martín Méndez, Alberto Lucio Martínez Torres, Javier Martínez Villanueva, Nora Matías Fernández, José María Meniño Cotón, Carlos Pena Rodríguez, Manuel Rodal Vila, Jaime Alberto Sánchez Rúa, María Teresa Sestelo Pérez, Marta			
E-mail	rluaces@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*) The objective of this course is that the student acquires the mastery of the basic techniques of Linear Algebra and Statistics that are necessary in other subjects that must be taken later in the degree.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C1	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.
D2	CT2 Problem solving.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.

Expected results from this subject	Training and Learning Results			
Acquire the basic knowledge on matrices, vector spaces and linear maps.	A2	B1 B2 B3	C1 C20 C22	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	A4	B1 B2 B3	C1 C22	D2 D5 D8
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.		B2 B3 B9 B14 B15	C1 C1 C2 C3 C4	D1 D2 D2 D3 D4 D5 D6 D9

Perform basic exploratory analysis of databases.		B1 B2 B3 B9 B10 B11 B12 B13 B14	C1 C1 C5 C6 C7 C9 C10 C13 C14 C15 C16	D1 D2 D3 D4 D5 D5
Model situations under uncertainty by means of probability.		B3	C1	D2
Know basic statistical models and their application to industry and perform inferences from data samples.		B3	C1	D2 D9
Use computer tools to solve problems of the contents of the course.	A2 A3	B3 B3 B4	C1 C7 C13 C14 C16 C17 C18	D1 D2 D3 D4 D6 D10

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
Problem and/or exercise solving	4.5	0	4.5

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

Methodologies	
	Description
Lecturing	The 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	Training and Learning Results		
Problem and/or exercise solving	CONTINUOUS ASSESSMENT (CA). Students who wish to take part in continuous assessment will have continuous assessment tests throughout the term. *** In Algebra, there will be three CA tests with the weights on the final grade of Algebra indicated: 2 partial exam(15% each test) to be held in the weeks scheduled by the Centre for the practices of the first term, and a third global exam (all subject contents) that will take place on the date of the exam of the global assessment option. In addition, 10% of the final mark in Algebra will correspond to class work and exercises. *** In Statistics, there will be two CA tests with the weights on the final Statistics grade indicated: the first one for topics 1 and 2 (20%) to be taken upon completion of these topics, and the second one will be global (80%) and will take place on the date of the exam of the global assessment option. GLOBAL ASSESSMENT (GA). Students who wish to take the GA will only have a final exam in Algebra and another in Statistics at the end of the term, which will include the whole subject.	100	B3	C1	D2 D5 D6 D9

Other comments on the Evaluation

Continuous Evaluation vs. Global Assessment. Students must choose between the Continuous Assessment (CA) and Global Assessment (GA) systems before the deadline established by the School.

Assessment 1st Opportunity. At the end of the term, once the continuous or global assessment exams have been completed, the student will have a grade out of 10 points for Algebra (A) and a grade out of 10 points for Statistics (S), which will represent 100% of the grade for each part. The final grade of the subject will be calculated as follows:

- If both grades A and S are greater 0 equal to 3.5, then the final grade will be (A+S)/2.
- If either grade A or S is less than 3.5, then the final grade will be the minimum of the amounts (A+S)/2 and 4.5.

A student will be given the grade of no-show if he/she does not sit for any of the CA or GA exams of the two parts of the subject after the deadline established by the center to decide between CA or GA; if, after that deadline, he/she sits for any test that corresponds to him/her according to that decision, he/she will be considered to have sat for it.

Assessment 2nd Opportunity. The evaluation of the students in the second edition of the minutes will be carried out by means of an exam of Algebra and another one of Statistics that will suppose 100% of the final grade of each part. To calculate the final grade of the subject the procedure described above will be applied. If at the end of the term (first edition of minutes) a student obtains a grade higher or equal to 5 points (out of 10) in one of the parts (Algebra or Statistics) then, in the second edition, he/she will be able to skip the final exam of that part and keep the grade obtained in the first edition.

Ethical commitment: The student is expected to present an appropriate ethical behaviour. In the case of detecting unethical behaviour (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 for the current academic year will be a failing grade (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 the subject in the current academic year and the overall grade will be a fail (0.0).

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,
Jay L. Devore, **Probability and Statistics for Engineering and the Sciences**, 8th edition,
Douglas C. Montgomery & George C. Runger, **Applied Statistics and Probability for Engineers**, 5th edition,
Openstax College (Internet), **Introductory Statistics**,
William Navidi, **Statistics for Engineers and Scientists**, 3rd edition,
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	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Martínez Martínez, Antonio			
Lecturers	Caeiro Oliveira, Sandro Díaz de Bustamante, Jaime Estévez Martínez, Emilio Martínez Martínez, Antonio Martínez Torres, Javier 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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C1	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.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.
D14	CT14 Creativity.
D16	CT16 Critical thinking.

Expected results from this subject	Training and Learning Results		
Understanding of the basic knowledges of differential calculation of one and of several variables.	B3	C1	D1
Understanding of the basic knowledges of integral calculation of functions of a variable.	B3	C1	D1
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.	B3 B3 B4	C1 C2	D2 D2 D9 D10 D14 D16
I handle of the technicians of integral calculation for the calculation of areas, volumes and surfaces.	B3 B3 B4	C1 C1	D1 D1 D2 D9 D14 D16

Utilisation of computer tools to resolve problems of differential calculation and of integral calculation.	B3 B4	C1 C1	D2 D2 D6 D9 D16

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	Training and Learning Results		
Problem and/or exercise solving	They will make controls written and/or works. The weight of each one of them will not surpass 30% of the continuous evaluation.	60	B3 B4	C1	D1 D2 D6 D9 D14 D16
Essay questions exam	It will do a final examination on the contents of the whole of the matter.	40	B3 B4	C1	D1 D2 D9

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	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Álvarez Llorente, Gema			
Lecturers	Álvarez Llorente, Gema Blanco González, Manuel Cerviño Rodríguez, Rodrigo Fernández Arias, María Jesús González Garrido, Ada Alicia González-Portela Garrido, Alicia Trinidad Sinde Cantorna, Ana Isabel Urgal González, Begoña			
E-mail	galvarez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This matter has like fundamental aim offer to the student a preliminary or introductory vision, of theoretical character-practical, relative to the nature and the operation of the business organisations and his relation with the surroundings in which they operate. For this, between other things, will define the term company from a multidimensional point of view that covers the complexity of his operation like open system. Later, we will analyse the relations of the company with his surroundings, and will go in in the study of his main functional areas that contribute to the correct development of his activity.			

Training and Learning Results	
Code	
B9	CG9 Ability to organize and plan within the sphere of a company, and other institutions and organizations.
C6	CE6 Adequate knowledge of the concept of enterprise and institutional and legal framework of enterprises. Organization and Business Management.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D7	CT7 Ability to organize and plan.
D18	CT18 Working in an international context.

Expected results from this subject		Training and Learning Results	
Know the role of the company in the field of economic activity.		C6	D18
Understand the basic aspects that characterize the different types of companies.		C6	D1 D18
Know the legal framework of the different types of companies.		C6	D1
Know the most relevant aspects of the organization and management in the company.	B9	C6	D1 D18
Acquire skills on the processes that affect business management.	B9	C6	D2 D7 D18

Contents	
Topic	
Subject 1: The COMPANY	1.1 The concept of company.1.2 The function of the company.1.3 The company like system.1.4 The surroundings of the company.1.5 The aims of the company.1.6 Classes of companies.

Subject 2: The FINANCIAL SYSTEM (PART I). ECONOMIC And FINANCIAL STRUCTURE OF THE COMPANY	2.1 economic Structure and financial of the company. 2.2 Bottom of rotation. 2.3 Cycle of exploitation and half Period of maduration. 2.4 Bottom of minimum rotation.
Subject 3: THE FINANCIAL SYSTEM (PART II). THE RESULTS OF THE COMPANY	3.1 The results of the company. 3.2 The profitability of the company. 3.3 The competitive strategy.
Subject 4: The FINANCIAL SYSTEM (PART III). INVESTMENT	4.1 Concept of investment. 4.2 Classes of investments. 4.3 Criteria for the evaluation and selection of investments.
Subject 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.
Subject 6: The SYSTEM OF PRODUCTION (PART I). GENERAL APPEARANCES	6.1 The system of production. 6.2 The efficiency. 6.3 The productivity. 6.4 Investigation, development and innovation (R&D)
Subject 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 The threshold of profitability. 7.6 The threshold of production. 7.7 The operative leverage.
Subject 8: The SYSTEM OF COMMERCIALISATION	8.1 ¿What is the marketing? 8.2 basic Concepts. 8.3 The tools of marketing: Marketing-*mix.
Subject 9: The SYSTEM OF ADMINISTRATION	9.1 Components of the system of administration. 9.2 The system of direction. 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	38.5	45.5	84
Problem solving	17.6	39.4	57
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	Lesson *magistral with material of support and audiovisual means. Exhibition of the main contents of the matter so that the student can understand the scope of the same and facilitate his understanding.
Problem solving	Activity in which they formulate problems and/or exercises related with the subject. The student will have to pose and develop of individual form the suitable solutions by means of the application of the knowledges purchased related with the matter object of study.

Personalized assistance

Methodologies	Description

Lecturing	The students will have occasion to attend to *tutorías *individualizadas with his professor. The procedure for *concertar these *tutorías will be communicated to the students by the professor to principle of course and will be published in the platform of teaching of the University. These *tutorías are allocated to resolve doubts and orient to the students on the development of the contents tackled in the theoretical classes, the practical classes and the works that can them entrust. In this section also includes the explanation to the students of any question on the proofs made along the course.

Assessment

	Description	Qualification	Training and Learning Results
Problem solving	In accordance with the educational planning of the academic course, the student will have to develop a determinate number of practices that include diverse exercises of application of the knowledges purchased in the classes of theory to concrete situations. These practices do not take part in the calculation of the qualification of the matter, but demands to the student obtain an exert minimum in the same for the *superación of the matter. The practices will carry out of face-to-face form being compulsory the assistance of the student to these classes.	0	B9 C6 D1 D2 D7 D18
Objective questions exam	They will make diverse proofs along the course in which they will evaluate the knowledges, the skills and the competitions purchased by the students so much in the classrooms of theory as of practices.	100	B9 C6 D1 D2

Other comments on the Evaluation

1. 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, 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 for the current academic year will be a fail (0.0).

2. Continuous evaluation system:

Following the guidelines of the degree and the agreements of the academic commission, students taking this subject will be offered a continuous evaluation system. This system will be applicable to all students who have not expressly waived this evaluation criterion following the official channels established by the center.

The continuous evaluation will consist of three tests with the following characteristics:

- First test of the continuous evaluation: It will be carried out during the school period, in the week set by the center, and will consist of a multiple choice test that will cover all the contents seen up to the moment of its completion, both in the theory classes as in internships.

- Second test of the continuous evaluation: It will be carried out during the school period, in the week set by the center, and will consist of the development of several problems similar to those carried out in the practical classes.

- Third test of the continuous evaluation: It will be carried out on the date and time set by the center within the exam period and will consist of a multiple choice test that will cover all the contents seen throughout the course, both in the theory classes as in internships.

The grade obtained in the subject that will appear in the first edition of the report will be calculated as 30% of the grade obtained in the first test, plus 30% of the grade obtained in the second test, plus 40% of the grade obtained in the third test of the continuous evaluation.

However, to pass the subject, it will be essential to have passed 75% of the practices carried out throughout the course and obtain a minimum grade of 4 out of 10 in the third test of the continuous evaluation. If the two requirements are not met, the student will obtain a failing grade in the first edition of the report.

None of the continuous evaluation tests can be recovered unless justified and duly accredited by the student. On the other hand, the student has the right to know the grade obtained in each test within a reasonable period after its completion and to discuss the result with the teacher.

The grade obtained, both in the continuous evaluation tests and in the practical ones, will only be valid for the academic year in which they are carried out.

3. Global evaluation system:

Students who have expressly waived continuous evaluation following the official channels established by the center will be offered an evaluation procedure that allows them to achieve the highest grade.

This procedure will consist of a global evaluation exam, which will be carried out on the date and time set by the center management, and in which all the contents developed in the subject will be evaluated, both in the theory classes and in the practices. This global evaluation exam will consist of two parts: a theory test in multiple choice format, which will account for 30% of the final grade, and another practical test, which will account for the remaining 70%, and will consist of a series of exercises. develop. It is a necessary condition to pass the subject to obtain a minimum score of 5 out of 10 in the multiple choice test. If the student does not pass the multiple choice test, the student's final grade will be the one obtained in said test evaluated out of 3.

Only those students who do not complete any of the evaluation tests included in this teaching guide will be considered 'Not presented'.

4. About the July call:

The recovery call (July) will consist of a global evaluation exam that will account for 100% of the final grade and in which all the contents developed in the subject will be evaluated, both in theory classes and in practical classes. This exam will consist of two parts: a theory test in multiple choice format, which will account for 30% of the final grade, and another practical test, which will account for the remaining 70%, and which will consist of a series of exercises to be developed. It is a necessary condition to pass the subject to obtain a minimum score of 5 out of 10 in the multiple choice test. If the student does not pass the multiple choice test, the student's final grade will be the one obtained in said test evaluated out of 3.

5. Prohibition of use of electronic devices:

The use of any electronic device will not be permitted during the evaluation tests, unless expressly authorized. The fact of introducing an unauthorized electronic device into the exam room will be considered 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
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	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish English			
Department				
Coordinator	Fernández Fernández, José Luís			
Lecturers	Arias González, Felipe Barro Guizán, Óscar Blanco García, Jesús Domínguez Alonso, José Manuel Fernández Fernández, José Luís Hermida Merino, Daniel López Vázquez, José Carlos Paredes Galán, Ángel Pou Álvarez, Pablo Román Freijeiro, Claudia Salgueiriño Maceira, Verónica Vázquez Besteiro, Lucas			
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			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C2	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.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
Understanding the basic concepts of electromagnetism and thermodynamics.	B3	C2	
Knowing the basic instruments for the measurement of physical quantities.		C2	
Knowing the basic techniques for experimental data evaluation.	B3	C2	D9 D10
Ability to develop practical solutions to basic technical problems in engineering, within the framework of electromagnetism and thermodynamics.	B3	C2	D2 D9 D10

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	Practicals related to classroom topics will be carried out. They may include: 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	Optional activities: 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	Training and Learning Results
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	B3 C2
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.	50	B3 C2 D2
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.	30	B3 C2
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	B3 C2 D9 D10

Other comments on the Evaluation

1. CONTINUOUS ASSESSMENT (EC)

Final mark G comprises the marks on the topics covered in the lectures (class test mark, weight 80%) and in the lab (laboratory mark, weight 20%).

1.1. CLASS TEST MARK

It will be obtained through two blocks of theoretical-practical tests, which we will refer to with the letters C (course) and F (final), each with a weight of 40% of G.

In the ordinary call, tests during the course (mark C0) and a final test (mark F1) will be taken. On the same day as the F1 test there will be an optional test C1 to replace C0, so that each student can choose between maintaining her/his mark C0 or taking the test to obtain a new mark C1 to replace C0.

The extraordinary call will comprise two tests, C2 and F2, equivalent in contents and assessment methodology (objective questions, essay questions and problem solving) to C1 and F1, respectively. In test C2, each student can choose between maintaining her/his previous mark from block C or taking the test to obtain a new mark to replace the previous one. In test F2, each student can choose between maintaining her/his previous mark from block F or taking the test to obtain a new mark to replace the previous one.

1.2. LABORATORY MARK

In the ordinary call, during the course you can obtain mark L0. This mark consists of two blocks, each with a weight of 10% of G: theoretical-practical tests (mark L0E), and practical reports (mark L0I): L0 = L0E + L0I. It is mandatory the attendance to all lab sessions to obtain the mark L0, otherwise, L0 = 0.0. On the same day as the F1 test there will be an optional theoretical-practical test L1 to replace L0, so that each student can choose between maintaining her/his previous mark L0 or taking the test to obtain a new mark L1 to replace L0.

In the extraordinary call there will be a theoretical-practical test L2, equivalent in contents and assessment methodology to L1. In test L2, each student can choose between maintaining her/his previous laboratory mark or taking the test to obtain a new mark to replace the previous one.

1.3. FINAL MARK

G = C (40%) + F (40%) + L (20%)

where C is the most recent of the C block marks, F is the most recent of the F block marks, and L is the most recent of the laboratory marks.

2. GLOBAL ASSESSMENT (EG)

Only those students who have been granted a waiver of continuous assessment can opt for this assessment modality.

Final mark G comprises the marks on the topics covered in the lectures (class test mark, weight 80%) and in the lab (laboratory mark, weight 20%).

2.1. CLASS TEST MARK

It will be obtained through a theoretical-practical test (mark denoted by A1 in the ordinary call and by A2 in the extraordinary call). In test A2, each student can choose between maintaining her/his previous class test mark or taking the test to obtain a new mark to replace the previous one.

2.2. LABORATORY MARK

It will be obtained through a theoretical-practical test (mark denoted by L1 in the ordinary call and by L2 in the extraordinary call). In test L2, each student can choose between maintaining her/his previous laboratory mark or taking the test to obtain a new mark to replace the previous one.

2.3. FINAL MARK

G = A (80%) + L (20%)

where A is the most recent of the class test marks, and L is the most recent of the laboratory marks.

3. END-OF-PROGRAM CALL

The end-of-program call follows the same scheme as the global assessment, with the exception that there is only one exam.

Final mark G for the end-of-program call:

G = A (80%) + L (20%).

4. GENERAL RULES

To pass the course, a student must obtain a final mark equal to or higher than 5 (out of 10).

Students who do not take any of the tests (C, F, A, L) on the day of the final test will receive a grade of "no presentado" for that call.

Within the specifications detailed in the preceding sections, the tests may consist of different variants within the same classroom or laboratory group.

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 final mark in the corresponding edition of the academic record for the subject will be "suspenso" (0.0).

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 and the final mark in the corresponding edition of the academic record for the subject 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,
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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,
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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	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Rodríguez Diéguez, Amador Rodríguez Damian, María			
Lecturers	Castro Rascado, Enrique Diéguez González, Luis Díez Sánchez, Ana Isabel Fernández Fernández, María Sila Fernández Nocelo, Laura López Fernández, Joaquín Pérez Cota, Manuel Rodríguez Damian, Amparo Rodríguez Damian, María Rodríguez Diéguez, Amador Romero Gaciño, Iago Sáez López, Juan			
E-mail	mrdamian@uvigo.es amador@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			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C3	CE3 Basic knowledge on the use and programming of computers, operating systems, databases and software applications in engineering.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D7	CT7 Ability to organize and plan.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Computer and operating system skills.	B3	C3	D5 D6 D7
Basic understanding of how computers work	B3	C3	D1 D5
Skills regarding the use of computer tools for engineering	B3	C3	D5 D6 D7 D17

Database fundamentals	B3	C3	D1 D5 D6 D7
Capability to implement simple algorythims using a programming language	B3 B4	C3	D2 D7 D17
Structured and modular programming fundamentals	B3 B4	C3	D2 D5 D17

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	Training and Learning Results
Practices through ICT	Group of proofs that include the solution of problems, exercises of practical type, and activities to resolve.	70	
Objective questions exam	Proofs for the evaluation of the competitions purchased that include questions with different alternative of answer (true/false, multiple election, ...)	15	B3 C3 D5
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 PROCEDURE

In the current academic year, continuous assessment will gather all learning evidence from the enrolled student and will be structured into three evaluations. These three assessments will preferably take place in computer labs; however, due to teaching organization needs, they may also be conducted in classrooms in handwritten format.

By default, students are enrolled in the continuous assessment system. To opt out, they must formally request to withdraw from it. If a student does not opt out, any missed assessments will be graded with a zero.

First Call (May/June):

To pass the course through continuous assessment, the following condition must be met:

(Test 1 * 0.3 + Test 2 * 0.4 + Test 3 * 0.3) ≥ 5

Therefore, a student is considered to have passed if they obtain a score of five or higher.

The assessments may consist of exams and/or assignments, meaning that a portion of the grade may be based on

submitted work and its evaluation.

Once the first assessment (Test 1) has been completed, the student may request to withdraw from the continuous assessment system (within the timeframe and through the means established by the course instructor). In this case, the student will follow the non-continuous assessment procedure.

Second Call (June/July):

If a student does not achieve a passing grade in the first call (May/June), they must take an exam covering 100% of the course content (10 points).

NON-CONTINUOUS ASSESSMENT PROCEDURE

This consists of an exam that allows students to obtain 100% of the final grade. The exam may be divided into sections with minimum score requirements.

First Call (May/June):

Students who have formally opted out of the continuous assessment system may take the exam scheduled for May/June (on the date and time set by the School Administration). This exam allows them to obtain 100% of the final grade. Students who failed the continuous assessment are not eligible to take this exam.

Second Call (June/July):

An exam will be offered to assess 100% of the course content for those who did not achieve the minimum passing grade 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

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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				
Mathematics: Calculus 2 and differential equations				
Subject	Mathematics: Calculus 2 and differential equations			
Code	V12G363V01204			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Fernández García, José Ramón			
Lecturers	Bajo Palacio, Ignacio Bazarra García, Noelia Caeiro Oliveira, Sandro Calvo Ruibal, Natividad Castejón Lafuente, Alberto Elias Durany Castrillo, José Estévez Martínez, Emilio Fernández García, José Ramón Martínez Torres, Javier Meniño Cotón, Carlos Pena Rodríguez, Manuel Sánchez Rúa, María Teresa			
E-mail	jose.fernandez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of the matter is making the student know the basic techniques of integral calculus in several variables, vector calculus, differential ordinary equations and its applications.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C1	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.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.
D15	CT15 Objectification, identification and organization.
D16	CT16 Critical thinking.

Expected results from this subject	Training and Learning Results		
Understanding of the basic concepts of integral calculus in several variables.	B3	C1	D1
Knowledge of the main techniques of integration of functions of several variables.	B3 B4	C1	D1 D2 D9
Knowledge of the main results of vector calculation and applications.	B3 B4	C1	D1 D2 D9
Acquisition of the basic knowledge for solving equations and linear differential systems.	B3 B4	C1	D1 D2 D9

Understanding of the importance of integral calculus, vector calculus and differential equations for the study of the physical world.	C1	D9 D16
Application of the knowledge of integral calculus, vector calculus and differential equations.	C1	D2 D6 D9 D16
Acquisition of the necessary capacity to use this knowledge in the manual and computer resolution of issues, exercises and problems.	C1	D1 D2 D3 D6 D9 D15 D16

Contents	
Topic	
Integration in several variables.	Double integral on rectangles. Reduction to integrals iterated. Double integral on elementary regions. Properties. Theorem of *Fubini. Theorem of the change of variable. Particular case of polar coordinates. Triple integral on a box and on elementary regions. Theorem of *Fubini. Theorem of the change of variable. Particular cases: cylindrical and spherical coordinates. Applications *geómetricas and physical of the multiple integral: calculation of volumes, centres of mass and moments of inertia.
Vectorial calculation	Curves in the plane and in the space. Length of arch. Change of parameter. Curvilinear integral or of path regarding the length of arch of scalar fields. Curvilinear integral or circulation of vectorial fields. Properties. Fundamental theorem of the integrals of line. Theorem of *Green in the plane. Regular surfaces. Plane *tangente. Normal vector. Area of a surface. Integral of surface of scalar fields. Flow or integral of surface of vectorial fields. Operators divergence and rotational. Characterisation of fields *conservativos. Theorem of *Stokes. Theorem of Gauss.
Differential equations	Ordinary differential equations. Concept of solution. Theorems of existence and uniqueness for problems of initial condition. Methods of resolution of ordinary differential equations of prime importance: in detachable variables, *reducibles to detachable variables, *homogéneas, linear and *reducibles to linear. Exact differential equations. Integral factors. Differential equation of a family *uniparamétrica of flat curves. Orthogonal paths. Linear differential equations of order 2. Problems of initial condition. Fundamental groups. Method of variation of parameters. Method of indeterminate coefficients. Reduction of order. Equation of Euler. Systems of linear differential equations of order 1.
Numerical methods for problems of initial value	Introduction to the numerical methods. Methods of Euler and Euler improved. Method of *Runge-*Kutta of order 4.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Problem solving	22	24	46
Laboratory practical	6	0	6
Essay questions exam	3	0	3
Essay	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The professor will expose in the theoretical classes the contents of the matter. The students will have basic texts of reference for the follow-up of the subject.
Problem solving	The professor will resolve problems and exercises and the student will have to resolve similar exercises to purchase the necessary capacities.
Laboratory practical	They will employ computer tools to resolve exercises and apply the knowledges purchased.

Personalized assistance	
Methodologies	**Description**

Problem solving	The profesor will personally help solving doubts and requirements from the students, especially in problem and laboratory clases and in office hours.
Laboratory practical	The profesor will personally help solving doubts and requirements from the students, especially in problem and laboratory clases and in office hours.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	They will make two partial (P1 and P2). The weight of each one of them will suppose 25% of the continuous evaluation.	50	B3 B4	C1	D1 D2 D3 D6 D9 D15 D16
Essay questions exam	It will make a final examination (EF) on the contents of all the matter. The weight of this examination will be of 40% for the students that opt by continuous evaluation and of 100% for those who do not receive to this.	40	B3 B4	C1	D1 D2 D3 D6 D9 D15 D16
Essay	In each group will propose diverse exercises or additional tasks (EJC) that will have a conjoint weight of 10% of the note of continuous evaluation.	10	B3 B4	C1	D1 D2 D6 D16

Other comments on the Evaluation

The continuous evaluation grade will be obtained by adding the grades P1, P2, EF and EJC weighted according to their weight. That is, if each test P1, P2, EF and EJC is weighted out of 10, then

NOTE EC=P1*0.25+P2*0.25+EJC*0.1+EF*0.4.

The student's final grade in the first edition of the report will be calculated as the maximum between the grade obtained by continuous evaluation and the grade of the final exam:

FINAL GRADE = MAX{EC GRADE, EF}.

Consequently, the grade of students who do not take the continuous evaluation will be the grade of the final exam.

Those who do not take the final exam will obtain the grade of NOT PRESENTED.

The evaluation in the second opportunity will consist of a single exam on the contents of the subject that will account for 100% of the grade.

Ethical commitment:

Students are expected to present appropriate ethical behavior. In case of detecting unethical behavior (e.g., copying, plagiarism, use of unauthorized electronic devices), it will be considered that he/she does not meet the requirements to pass the subject. In this case, the overall grade for the subject in the current academic year will be a fail with a numerical grade of 0.

Sources of information

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

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Algebra and statistics/V12G320V01103
Mathematics: Calculus 1/V12G320V01104

Other comments

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

IDENTIFYING DATA				
Chemistry: Chemistry				
Subject	Chemistry: Chemistry			
Code	V12G363V01205			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cruz Freire, José Manuel			
Lecturers	Álvarez Leirós, Carla Cruz Freire, José Manuel García Martínez, Emilia Gómez Costas, Elena Moldes Menduíña, Ana Belén Moldes Moreira, Diego Novoa Carballal, Ramón Nóvoa Rodríguez, Ramón Pérez López, Marta Ramos Berdullas, Nicolás Rey Losada, Francisco Jesús Rodríguez Riego, Rafael Salgado Seara, José Manuel Sánchez Vázquez, Pablo Breogán Santos Fernandes, Helena Raquel Dos Talavera Nevado, María Vázquez Rico, Carlos 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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
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.	B3	C4	D2 D3 D10 D17

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
3. Thermochemistry	3.1. Heat of reaction: Definition of Enthalpy and Internal Energy. Enthalpy of reaction. Temperature Dependence of Enthalpy Changes. Enthalpy of formation. Determination of the reaction enthalpy: direct method. State Function and Hess's Law. 3.2. Entropy: Definition. Calculus. 3.3. Free energy: Definition. Calculus. The Criterion of Evolution.
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	Training and Learning Results
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	B3 C4 D2 D3 D10
Objective questions exam	The purpose of these tests, is to assess the level of theoretical knowledge acquired by students in classroom sessions. Written tests (one or more) are multiple choices, multiple responses, in which students can achieve a numerical score between 0 and 10, according to current legislation.	40	B3 C4 D10
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	B3 C4 D2 D10
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	C4 D17

Other comments on the Evaluation

The objective questions tests for theory content, and the exercises examen, will be considered for the final score weighting only when both the average grade of the multiple-choice test and the grade of the exercises examen rated greater than or equal to 4. Although the average score could be equal to or greater than 5, if the average qualification of the objective questions tests for theory content or the exercises exam is lower than 4, the final score will be the lowest mark obtained (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 who make a 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.

In the second call, an objective questions test for theory content and an exercises examen will be carried out. The marks of lab experiments, autonomous problem solving, and marks of average of objective questions tests for theory content or exercises exam higher than 5 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,
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,
Rosenberg, J. y col, **Química Schaum**, Ed. McGraw Hill,
Herrero Villén, M.A. y col, **Problemas y cuestiones de Química**, Ediciones UPV,
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	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Figueroa Martínez, Raúl Abreu Fernández, Carmen María			
Lecturers	Abreu Fernández, Carmen María Díaz Fernández, Belén Figueroa Martínez, Raúl Pena Uris, Gloria María			
E-mail	cabreu@uvigo.es raulfm@uvigo.gal			
Web	http://moovi.uvigo.gal/			
General description	The objective pursued with this course is to introduce the student to the knowledge of material structure and properties, their applications, and processing. It constitutes the base for other subjects in subsequent courses. English-friendly program subject: International students may request from the faculty: a) materials and bibliographic references for following the subject in English, b) English-language tutorials, c) tests and evaluations in English.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
C9	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.
D1	CT1 Analysis and synthesis.
D5	CT5 Information Management.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
Understand the main concepts about chemical bonds, structure and microstructure of different types of materials	B3	C9	D10
Understand the relationship between microstructure and properties (mechanical, electrical, thermal and magnetic) in a material	B3	C9	
Understand the mechanical performance of metallic, ceramic, plastic and composite materials.	B4 B6		
Know the possibilities of modification of material properties through mechanical processing and thermal treatment	B4	C9	D9
Know the main techniques for materials characterization	B3 B6	C9	
Acquire abilities in handling materials diagrams and charts			D1
Acquire abilities in undertaking standardized tests on materials, under supervision	B6	C9	D10
Analysis of the obtained results and draw conclusions from them			D1 D5 D9
Competence to apply standards to materials testing	B6		D1 D9

Contents	
Topic	
Introduction	Introduction to Materials Science and Technology. Classification of materials. Terminology. Guidelines for for the proper follow-up of the course.
Crystalline arrangement.	Crystalline and amorphous solids. Crystalline lattices, characteristics and imperfections. Allotropic transformations.
Properties of materials. Laboratory practicals.	Mechanical, chemical, thermal, electric and magnetic properties. Standars for materials analysis. Compressive and tensile deformation. Principles of fracture mechanisms. Toughness. Hardness. Main mechanical 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 testing 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	30	56	86
Laboratory practical	16.75	18	34.75
Autonomous problem solving	0	12.2	12.2
Mentored work	0	9	9
Self-assessment	0	0.3	0.3
Report of practices, practicum and external practices	0	2	2
Presentation	0.25	0	0.25
Objective questions exam	1	0	1
Objective questions exam	1.75	0	1.75
Objective questions exam	1.75	0	1.75
*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 course, the teacher exposes the main contents, 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**
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 can take throughout the course, and will guide the students in their completion, solving the technical questions that may arise

Assessment

	Description	Qualification	Training and Learning Results
Report of practices, practicum and external practices	Attendance and student participation in practical classes will be evaluated. The reports from the practical sessions will be assessed, which will include the results obtained from the conducted experiments, as well as the response to the questions asked..	5	B6 C9 D9
Presentation	The work carried out by the students in small groups will be evaluated through its public defense, using a rubric that will be presented beforehand. The information provided, consulted bibliography, organization of the content, clarity in the presentation, and the responses given in the final debate with the teacher and the rest of the students will be taken into account.	10	B4 C9 D1 B6 D5 D10
Objective questions exam	This written test will assess the learning gain and competence of students in the laboratory practical part of the course. It will consist of questions and exercises.	15	B3 C9 D1 B4 D5 B6 D9 D10
Objective questions exam	Partial exam I:There will be a first written test in which the knowledge acquired by students in the theory sessions of the subject will be assessed. It will be conducted approximately in the middle of the semester.	30	B3 C9 D1 B4 D5 B6 D9 D10
Objective questions exam	Partial exam II: Second written test in which the knowledge acquired by students in the theory sessions of the subject will be evaluated. It will take place on the official date of the 1st edition of the exam set by the EEI coordination.	40	B3 C9 D1 B4 D5 B6 D9 D10

Other comments on the Evaluation

Continuous assessment: (default assessment system) involves ongoing evaluation throughout the semester including different assessments, as indicated in the table above which also includes the score of each test in the final mark. A summary is shown below:

- 5% laboratory practice report submitted, attendance, and participation in practical classes.
- 10% Oral presentation of group work.
- 15% Written examination of the practical part.
- 30%* Partial Exam I: 1st partial exam of theory content (It will take place in one of the theory sessions on a previously indicated date).**A minimum is required.**
- 40%* Partial Exam II: The knowledge acquired in the second part will be assessed, however, an overall understanding of the subject will be required. (it will take place on the date officially set by the EEI for the first attempt or edition). **A minimum is required.**

- * Students who take the second attempt will keep the marks obtained in the laboratory practical assessments. The theoretical knowledge of the subject will be evaluated in a single exam (covering the syllabus evaluated in Partial Exams I and II) that will be assessed with 70% of the total grade. **A minimum is required.**

Global or comprehensive assessment in the two official attempts: Students who waive continuous assessment, in accordance with the procedures and deadlines established by the institution, will have the option to take a single written exam covering all the content of the subject, both theoretical and practical, on the official dates. This test will be graded with a weight of 100% towards the final grade.

If the minimum in Partial Exam I is not reached, the option of Global assessment can also be chosen by applying in writing within the deadline set by the responsible teachers.

To pass the course, according to the assessment system: - Continuous assessment:

- In the first attempt: The sum of scores from different tests must reach a minimum of **5 out of 10, and a minimum of 40% must be obtained in each of the Partial exams, i.e. 1.2 points for Partial I and 1.6 points for Partial II. Alternatively, the minimum can be 45% considering the two Parcial exams together, i.e. 3.15 points out of 7.**
- In the second attempt: The sum of scores from different tests must reach a **minimum of 5 out of 10,** and obtaining a **minimum of 45%** of the grade of the exam, that is: **3.15 point out of 7**.
- **If the required minimums are not reached, the grade that will appear in the transcript will be a maximum of 4.5 points.**

- Comprehensive evaluation: A minimum score of 5 out of 10 must be achieved.
Extraordinary Call (September): will take place on the official date. A comprehensive assessment will be performed by means of a single written exam covering all theoretical and practical contents (100% of the final grade). **Ethical Behavior:** students are expected to behave in an ethical manner in all aspects of their work, especially in accordance with the provisions of Articles 39, 40, 41and 42 of the Regulation on the evaluation, grading and quality of teaching and the learning process of students at the University of Vigo , approved by the University Senate on 18 April 2023). **Warning:** 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
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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

Other comments

It is recommended that students, before enrolling in this course, have passed or, at least, enroll in the subjects of the previous academic year.

In the event of discrepancies in the information contained in this guide, it will be understood that the version published in Spanish prevails.

IDENTIFYING DATA

Fundamentos de teoría de circuítos e máquinas eléctricas

Subject	Fundamentos de teoría de circuítos e máquinas eléctricas			
Code	V12G363V01302			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language				
Department	Enxeñaría eléctrica			
Coordinator	Albo López, María Elena Villanueva Torres, Daniel			
Lecturers	Villanueva Torres, Daniel			
E-mail	ealbo@uvigo.gal 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.			

Resultados de Formación e Aprendizaxe

Code	
B3	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.
C10	CE10 Coñecemento e utilización dos principios de teoría de circuítos e máquinas eléctricas.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D10	CT10 Aprendizaxe e traballo autónomos.
D14	CT14 Creatividade.
D17	CT17 Traballo en equipo.

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
Comprender os aspectos básicos da operación dos circuítos e as máquinas eléctricas	B3	C10	D10 D17
Saber o proceso experimental utilizado cando traballa con circuítos eléctricos e *maquinar eléctrico		C10	
Saber os técnicos actuais dispoñibles para a análise de circuítos eléctricos	B3		D2 D6
Saber os técnicos de medida dos circuítos eléctricos		C10	D2 D17
Habilidades de compra no proceso de análise de circuítos eléctricos	B3		D2 D14

Contidos

Topic	
TEMA 1. INTRODUCIÓN E AXIOMAS	1.1 Magnitudes e unidades. 1.2 Referencias de polaridade. 1.3 Concepto de circuíto eléctrico. 1.4 Axiomas de Kirchhoff.

TEMA 2. ANÁLISE DE CIRCUÍTOS LINEAIS RESISTIVOS	2.1 Elementos ideais: definición, representación e modelo matemático. 2.2 Modelos de fontes reais. 2.3 Dipolos equivalentes: conversión de fontes. 2.4 Asociación de resistencias: concepto de divisor de tensión e divisor de intensidade. 2.5 Asociación de fontes e resistencias. 2.6 Conceptos topolóxicos: nó, rama, lazo e malla. 2.7 Número e elección de ecuacións circulares e nodais linealmente independentes. 2.8 Análise por mallas e nós de circuítos con resistencias. 2.9 Transformacións topolóxicas. 2.10 Potencia e enerxía en resistencias, fontes ideais e fontes reais. 2.11 Teoremas fundamentais.
TEMA 3. ANÁLISE DE CIRCUÍTOS CON ELEMENTOS ALMACENADORES DE ENERXÍA	3.1 Condensador ideal: definición, representación e modelo matemático. 3.2 Circuítos magnéticos: unidades, fluxo magnético, forza magnetomotriz e reluctancia. 3.3 Bobina ideal: definición, representación e modelo matemático. 3.4 Asociación serie e paralelo de bobinas e condensadores. 3.5 Circuítos con elementos almacenadores de enerxía. Circuítos RL, RC e RLC.
TEMA 4. ANÁLISE DE CIRCUÍTOS EN RÉXIME ESTACIONARIO SINUSOIDAL	4.1 Formas de onda periódicas e valores asociados: onda sinusoidal. 4.2 Determinación do réxime estacionario sinusoidal polo método simbólico. 4.3 Resposta dos elementos pasivos básicos antes excitacións sinusoidales: concepto de impedancia e admitancia complexa. 4.4 Lei de Ohm e axiomas de Kirchhoff en réxime estacionario sinusoidal. 4.5 Asociación de elementos. 4.6 Análise por nós e por mallas de circuítos en réxime estacionario sinusoidal. 4.7 Potencia e enerxía en réxime estacionario sinusoidal. Potencia instantánea, potencia media ou activa e enerxía nos elementos pasivos: bobinas, condensadores, resistencias e impedancias complexas. 4.8 Potencia e enerxía nos dipolos. Potencia aparente, potencia reactiva e potencia complexa. 4.9 Teorema de conservación da potencia complexa (teorema de Boucherot). 4.10 O factor de potencia e a súa importancia nos sistemas eléctricos. Corrección do factor de potencia. 4.11 Medida da potencia activa e reactiva: watímetros e varímetros. 4.12 Teoremas fundamentais en réxime estacionario sinusoidal.
TEMA 5: AXUSTES MAGNÉTICOS	5.1 Bobinas axustadas magnéticamente: definicións, ecuacións de fluxos, inductancias propias e mutuas. Representacións e modelos matemáticos. 5.2 Análise por mallas de circuítos de corrente alterna con bobinas axustadas.
TEMA 6: SISTEMAS *TRIFÁSICOS EQUILIBRADOS	6.1 Introdución. Sistema trifásico de tensións. Secuencia de fases. 6.2 Xeradores e cargas trifásicas: conexións estrela e triángulo. Tensións e intensidades. 6.3 Transformacións equivalentes estrela-triángulo. 6.4 Análise de sistemas trifásicos equilibrados. Circuíto monofásico equivalente. 6.5 Potencia en sistemas trifásicos equilibrados. Compensación do factor de potencia.
TEMA 7. MÁQUINAS ELÉCTRICAS	7.1 Tranformadores e autotranformadores. 7.2 Máquinas eléctricas rotativas: máquina síncrona, máquina asíncrona e máquinas de corrente contínua.

PRÁCTICAS	1. Descrición do laboratorio. Seguridade eléctrica: Contacto Directo/Indirecto. Introdución ao RD 614/2001 sobre disposicións mínimas para a protección da saúde e seguridade da traballadores fronte ao risco eléctrico. EPI/Aparamenta/Instalacións/Protocolos de Seguridade fronte a Risco Eléctrico. Estudo de Casos. LabTdC 2. Equipos de medida (polímetro, pinza amperimétrica, vatímetro dixital, osciloscopio dixital, analizador de rede) e de xeración (fonte DC, fonte AC, fonte trifásica) utilizados no laboratorio. Métodos para realizar as medidas de tensión, intensidade, potencia con efectividade e seguridade. LabTdC 3. Asociacións de elementos. Equivalencia estrela-triángulo. LabTdC 4. Introdución á análise e simulación de circuítos mediante Matlab. 5. Simulación de réxime transitorio mediante Matlab. 6. Circuíto RLC serie e paralelo. Media de tensións, intensidades, potencias. Determinación de Impedancia/Admitancia Equivalente. LabTdC 7. Compensación de Reactiva en Circuítos RL serie e paralelo. LabTdC

Planificación

	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	18	10	28
Resolución de problemas	10	10	20
Resolución de problemas de forma autónoma	0	20	20
Lección maxistral	22	44	66
Exame de preguntas de desenvolvemento	1.5	0	1.5
Exame de preguntas de desenvolvemento	1.5	0	1.5
Informe de prácticas, prácticum e prácticas externas	0	8	8
Traballo	0	5	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	Realizaranse montaxes prácticas correspondentes aos coñecementos adquiridos nas clases de teoría, ou ben se verán no laboratorio aspectos complementarios non tratados nas clases teóricas.
Resolución de problemas	Resolveranse problemas e exercicios tipo nas clases de grupos grandes e o alumno terá que resolver exercicios similares.
Resolución de problemas de forma autónoma	O alumno deberá resolver pola súa conta unha serie de exercicios e cuestións da materia proposta polo profesor.
Lección maxistral	O profesor exporá nas clases de grupos grandes os contidos da materia.

Atención personalizada

Methodologies	Description
Resolución de problemas	Nos horarios de tutorías o profesor atenderá persoalmente as dúbidas e consultas dos alumnos.
Prácticas de laboratorio	O profesor atenderá persoalmente as dúbidas e consultas dos alumnos.

Avaliación

	Description	Qualification	Training and Learning Results
Exame de preguntas de desenvolvemento	Probas EC1: Realizarase na data fixada pola EEI para as probas de EC. Avaliarase os contidos impartidos na aula/laboratorio até a data. Valoración 40% da Nota Final. Nota mínima de 3 puntos sobre 10 para poder aprobar a materia por EC.	40	B3 C10 D2 D10 D14
Exame de preguntas de desenvolvemento	Probas EC2: Realizarase na data fixada pola EEI para as probas de Evaluación Global. Avaliarase os contidos impartidos na aula/laboratorio e non incluídos na proba EC1 . Valoración 40% da Nota Final. Nota mínima de 3 puntos sobre 10 para poder aprobar a materia por EC.	40	B3 C10 D2 D10 D14

Informe de prácticas, prácticum e prácticas externas	Valorarase positivamente a realización dunha memoria de cada unha das prácticas realizadas no laboratorio de Teoría de Circuitos y/o Máquinas Eléctricas, que incluirá: obxectivos, procedemento seguido, materiais empregados, resultados obtidos e interpretación dos mesmos. No caso de non asistir a unha das prácticas, a nota nesa práctica será de cero puntos. A nota final de prácticas obterase como media aritmética das notas obtidas en cada unha das prácticas.	12	B3 C10	D2 D6 D10 D14
Traballo	Co obxectivo de fortalecer a capacidade de comunicación e traballo en equipo, os estudantes deberán presentar un traballo en grupo que trate sobre os obxectivos, contidos, desenvolvementos e resultados obtidos nas dúas prácticas programadas, realizadas utilizando o programa MATLAB. O traballo evalúa a labor en grupo dos estudantes en ambas prácticas en conxunto, por tanto a non asistencia a unha delas leva consigo unha nota de cero puntos no traballo.	8	B3 C10	D2 D6 D14 D17

Other comments on the Evaluation

AVALIACIÓN CONTÍNUA (EC).

Convocatoria da 1ª oportunidade

Xunto coa proba EC2, os alumnos que o desexen poderán realizar unha proba de recuperación do contido avaliado en EC1 ou conservar a nota obtida previamente.

A realización das practícas e presentación das memorias, forman parte do proceso de avaliación continua do alumno. Non obstante os alumnos que non realicen as mesmas, ao longo do curso, ou desexen mellorar a nota obtida, poderán optar a realizar un exame escrito adicional con preguntas relativas ao desenvolvemento das prácticas e aos contidos docentes explicados durante as mesmas, realizadas no laboratorio de Teoría de Circuitos y/o Máquinas Eléctricas. A valoracion deste exame é do 12% da nota final, de igual forma que a avaliación continua.

Non é posible recuperar a proba de traballo en grupo cun exame.

Se o estudante obtivo alomenos 3 puntos sobre 10 tanto na proba EC1 como na EC2, o cálculo da nota final realizarase do seguinte xeito:

Nota Final 1ª oportunidade = (Nota_EC1 + Nota_EC2) * 0.4 + Nota_ECL* 0.12 + Nota_ECT*0.08

onde, Nota_EC1, Nota_EC2, Nota_ECL e Nota_ECT son, respectivamente, as notas das probas EC1, EC2, a nota de prácticas de laboratorio de Teoría de Circuitos e a nota do Traballo, avaliadas entre 0 e 10 puntos.

Dado que existe una nota mínima de tres puntos sobre 10 en EC1 y en EC2 para poder aprobar a materia, se o estudante ***NON*** obtivo ao menos 3 puntos sobre 10 tanto na proba EC1 como na EC2, o cálculo da nota final realizarase como no caso anterior, cunha nota máxima de 4,5 puntos (suspenso).

Na convocatoria da 2ª oportunidade, o alumno que non renuncie á EC poderá conservar a nota obtida en EC1, ou EC2 na 1ª oportunidade ou realizar unha proba de recuperación da parte ou partes que desexe. Se o estudante se presenta a algunha das probas na 2ª convocatoria, renuncia á nota obtida ao longo do curso en dita proba.

O cálculo da nota final, realízase da maneira idéntica á vista para a 1ª oportunidade

Para aprobar a materia, tanto na 1ª, coma na 2ª oportunidade, a Nota Final deberá ser, polo menos, de **5.0** puntos.

Cada NOVA MATRÍCULA na materia supón unha posta a cero das cualificacións nas actividades de avaliación continua obtidas en cursos anteriores, coas seguintes excepcións:

as prácticas e o traballo en grupo, que se recoñecerán unicamente no curso seguinte de habelas realizado, si o estudante solicítao e cumpre estas seguintes condiciones:

 O estudante realizou efectivamente as prácticas no laboratorio e o traballo en grupo no curso anterior (non exame de prácticas nin recoñecidas de cursos anteriores) e

 O estudante obtivo unha nota de polo menos 5 puntos sobre 10, no curso anterior, tanto nas prácticas como no traballo en grupo.

AVALIACIÓN GLOBAL (EC).

Os alumnos que renuncien á avaliación continua, na datas establecidas pola EEI e figuren nas listas oficiais publicadas pola EEI , deberán realizar unha proba escrita EGA, con valoración do 80% da Nota Final na que se avalían os contidos impartidos nas clases de aula, e unha proba tamén escrita EGL cunha valoración do 20% da Nota Final que avaliará as competencias impartidas nas clases prácticas (prácticas de laboratorio de Teoría de Circuitos y prácticas de Matlab).

Nota Final 1ª oportunidade = Nota_EGA * 0.8 + Nota_*EGL * 0.2

Na 2ª oportunidade de Xuño-Xullo, a avaliación farase da mesma maneira. Tense unha proba escrita EGA con valoración do 80% da Nota Final e unha proba EGL con valoración do 20% para avaliar os contidos impartidos nas prácticas.

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, por exemplo) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Nese caso a calificación global no presente curso académico será de suspenso (0.0).

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

Bibliografía. Fontes de información

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

Recomendacións

Subjects that it is recommended to have taken before

Física: Física II/V12G320V01202
Informática: Informática para a enxeñaría/V12G320V01203
Matemáticas: Álxebra e estatística/V12G320V01103
Matemáticas: Cálculo II e ecuacións diferenciais/V12G320V01204

Other comments

É moi recomendable que os alumnos teñan coñecementos suficientes da álxebra dos números complexos, algebra lineal, ecuacións diferenciais lineais e coñecementos básicos de teoría de circuítos e ofimática:

 En concreto, esta materia parte e apóiase dos contidos estudados en Física II, realizando un mero repaso no primeiro tema Introdución daqueles aspectos relacionados directamente coa Teoría Circuítos. É por tanto recomendable, para o correcto seguimento da materia, ter aprobada Física II.

 Por outra banda, todo o cálculo en R.E.S. realízase aplicando operacións de números complexos (suma, resta, multiplicación, división, conxugado), por tanto é fundamental dominar a álxebra de números complexos (Matemáticas I) para poder seguir adecuadamente esta materia.

 Ademais, son precisos coñecementos de cálculo matricial para estudar os métodos de análise de circuitos por nós e malhas, en particular a súa implementación en Matlab.

 Por último, no estudo do réxime transitorio empregan ecuacións diferenciais e transformada de Laplace (Calculo I y II).

 E, tanto para poder realizar as prácticas en Matlab, como para redactar os informes de prácticas e o traballo, precisan uns coñecementos mínimos de ofimática.

Por todo iso, é conveniente superar as materias de Física II, Cálculo (I y II), Matemáticas I, e Informática antes de matricularse de desta materia

IDENTIFYING DATA

Mechanism and machine theory

Subject	Mechanism and machine theory			
Code	V12G363V01303			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	English			
Department				
Coordinator	Segade Robleda, Abraham			
Lecturers	González Baldonedo, Jacobo Segade Robleda, Abraham			
E-mail	asegade@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.			

Training and Learning Results

Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
D2	CT2 Problem solving.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D16	CT16 Critical thinking.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
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.	B3 B4	C13	D2 D6 D9 D10 D16
To know, comprehend, apply, and practice the concepts related to Mechanism and Machines Theory.	B3 B4	C13	D2 D6 D9 D10 D16
To know and apply kinematic and dynamic analyses techniques to mechanical systems.	B3 B4	C13	D2 D6 D9 D10 D16
Efficiently know and utilize software for analysis of mechanisms.	B3 B4	C13	D2 D6 D9 D10 D16

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	12.5	30	42.5
Laboratory practical	18	47	65
Problem and/or exercise solving	0	3	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	Training and Learning Results
Problem solving	Problem-solving tests will be conducted during the approved school schedule. None of the tests may exceed the legally established maximum percentage. Minimum grades may be set for any of the tests to access the overall weighting. The content, dates, weights, and other specific details of each test will be published through the online teaching platform with an appropriate minimum advance notice, never less than two weeks before.	30	B3 C13 D2 B4 D6 D9 D10 D16

Laboratory practical	Resolution and delivery of the previous tasks to each practice. Attendance to the Laboratory/computer Classroom, and deliveries of memories and/or questionnaires through the on-line platform. Both parts will have a maximum assessment of 3 points of the final note. To be able to be evaluated in this section the student will have to assist to a minimum number of 7 practices. Learning outcomes: they evaluate all.	30	B3 B4	C13	D2 D6 D9 D10 D16
Problem and/or exercise solving	The assessment will take place in a final written exam on the date specified in the exam schedule. This test will evaluate all the content covered in the subject. Learning outcomes: All will be assessed.	40	B3 B4	C13	D2 D6 D9 D10 D16

Other comments on the Evaluation

Continuous Assessment

1st Edition

The subject will be passed if a grade* of 5 or higher is obtained as the final grade, as follows:

- Attendance with satisfactory performance in the Laboratory/Computer Classroom, the grading of pre-lab tasks, reports, and/or questionnaires in each practice session, and the developed projects will have a maximum value of 3 points of the final grade.
- Continuous assessment tests will have a total maximum value of 3 points of the final grade.
- The final exam will have a maximum value of 4 points of the final grade. A minimum of 1.5 out of 4 on the final exam is required to pass the subject. If the minimum is not achieved on the final exam, the final grade will be the grade of this exam weighted out of 10.

2nd Edition

In the second edition, the problem-solving tests can be retaken, so that the final exam will have a maximum value of 7 points with a minimum score of 2.5 (out of 7). The final grade for those who do not achieve the minimum in this part will be the grade of the second edition problem-solving test weighted out of 10 points.

Global Assessment

Those opting for the global assessment system following the mechanisms established by the School of Industrial Engineering will be evaluated as follows:

- Evaluation of the practical part: This test consists of solving a series of questions related to the content covered in the practical sessions of the subject. It will have a maximum value of 3 points.
- Problem-solving and/or exercises test: The final exam will have a maximum value of 7 points of the final grade. A minimum of 2.5 out of 7 is required in this part of the assessment system. If the minimum is not achieved in the final exam, the final grade will be the grade of this exam weighted out of 10.

Ethical Commitment:

Students are expected to exhibit appropriate ethical behavior. In the case of detecting unethical behavior (cheating, 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 for the current academic year will be a fail (0.0).

No devices are allowed during the evaluation tests unless expressly authorized. Introducing unauthorized devices into the examination room will be considered grounds for not passing the subject in the current academic year, resulting in an overall grade of fail (0.0).

*A numerical grading system from 0 to 10 points will be used according to current legislation (RD 1125/2003 of September 5, BOE of September 18).

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	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Rodríguez Diéguez, Amador Moares Crespo, José María			
Lecturers	Diéguez González, Luis Moares Crespo, José María Rodríguez Diéguez, Amador Sousa Vázquez, Juan Manuel			
E-mail	jmmoares@gmail.com amador@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.			

Training and Learning Results
Code

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

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 operations. 2.4 Forms of representation of a program. 2.5 Types of modules of program. 2.6 linear Programming and estructurada. 2.7 Binary variables. Inputs, outputs 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 techniques. 3.2 Modelling with Petri Nets. 3.2.1 Definition of places and transitions. Rules of evolution. 3.2.2 Conditional election among several alternatives. 3.2.3 Simultaneous sequences. Concurrence. Sharing resources. 3.3 Implementation of Petri Nets.
4. Control systems introduction.	4.1 Systems of regulation in open and closed loop. 4.2 Typical control loop. Nomenclature and definitions.
5. Representation, modelling and simulation of continuous dynamic systems.	5.1 Physical systems and mathematical models. 5.1.1 Mechanical systems. 5.1.2 Electrical systems. 5.2 Modelling in transfer function. Laplace transform: Properties. 5.3 Block 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 System 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, integral and derivative effects. 7.2 PID controller. 7.3 Empirical methods for industrial controller tuning. 7.3.1 Open loop tuning: Ziegler-Nichols and others. 7.3.2 Closed loop tuning: Ziegler-Nichols and others.
P1. Introduction to PLC programming software.	Introduction to the software that allows to create and modify PLC programs.
P2. Basic elements of PLC programming	Modelling and implementation of simple automation systems.
P3. Implementation of simple Petri Net.	Petri Net modelling, implementation and debugging of a simple automation system.
P4. Implementation of medium complexity Petri Nets.	Petri Net modelling, implementation and debugging of a Petri Net involving counters and timers.
P5. Modeling and implementation of an advanced Petri net.	Modeling and implementation of a Petri Net with concurrency.
P6. Introduction to MATLAB.	Introduction to the relevant MATLAB system analysis instructions.
P7. Systems and transfer functions with MATLAB.	Systems analysis using their transfer functions.
P8. Modeling and time response in SIMULINK.	Modeling and simulation of control systems with SIMULINK.
P9. PID controller design.	Determination of PID controller parameters using the methods studied in class and subsequent verification of their performance.

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	Training and Learning Results
Laboratory practical	It will grade each lab session between 0 and 10 points, including the pre-session work. The proffesional behavior during the lab session will be taken into account for the grade. Lab sessions are weighted differently in the final grade.	20	
Essay questions exam	Written exams. It may comprise theory questions and problems. Graded between 0 and 10. More than one exams may be carried out on the dates and times set at the begining of the course. None of the tests has a weight above 40% of the final grade.	80	

Other comments on the Evaluation

- The student's performance in the lab will be subject to **Continuous Assessment** throughout the lab sessions scheduled for the semester; **attendance at these sessions is mandatory**. In the event of not passing the Continuous Assessment, students will be required to take a **practical exam**. This exam is conditional upon passing the written exam and will be held during the **second examination period** (second call) on a date following the written test. It will cover all content from the regular lab sessions that was not successfully passed.

- For students who officially **opt out of Continuous Assessment**, the evaluation of their lab work will consist of a **practical exam**. This exam, which is conditional upon passing the written exam, will be available in both the first and second examination periods. It will take place on a date after the written test and will cover the same content as the regular lab sessions.

- **Prerequisites may be established** for each lab session. Failure to meet these requirements may result in a **limitation of the maximum achievable grade** for that practical work.

- To pass the subject, students must pass both the **written and practical assessments**. If a student fails one or both of these assessments, a **scaling factor may be applied** to the partial grades, ensuring that the final overall grade does not exceed **4.5 out of 10**.

- Within any given exam, a **minimum score may be required** for a specific set of **theory questions and/or problems** in order to pass the exam as a whole.

- During the second examination period of the same academic year, students must be re-assessed on the components (written and/or practical) that they did not pass in the first period. **The same assessment criteria will apply**.

- In accordance with the Regulations for Continuous Assessment, students who participate in any assessable activity listed in the **Course Guide (Syllabus)** will be officially recorded as **"Presented"** for assessment (precluding a "Did Not Attend" status).

- **Ethical Commitment:** Students are expected to adhere to **appropriate ethical standards of conduct**. In the event that unethical behavior is detected (e.g., **cheating, plagiarism, use of unauthorized electronic devices**), the student will be deemed to have failed to meet the necessary requirements to pass the course. Consequently, their final grade for the current academic year will be a **fail (0.0)**.

- **Weighting of Assessments** Several continuous assessment tasks will be scheduled to ensure that **no single task accounts for more than 40%** of the final grade. All assessments will take place on the dates and times officially approved by the **School**/**Faculty**.

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

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

Recommendations

Subjects that continue the syllabus

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

Subjects that are recommended to be taken simultaneously

Electronic technology/V12G380V01404

Subjects that it is recommended to have taken before

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

Other comments

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

IDENTIFYING DATA				
Fundamentos de organización de empresas				
Subject	Fundamentos de organización de empresas			
Code	V12G363V01305			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Inglés			
Department	Organización de empresas e márketing			
Coordinator	Bellas Rivera, Roberto			
Lecturers	Bellas Rivera, Roberto			
E-mail	rbellas@uvigo.es			
Web				
General description	O obxectivo do curso é presentar as principais funcións da xestión de operacións, así como os métodos e técnicas específicos que se utilizan neste campo.			

Resultados de Formación e Aprendizaxe	
Code	
B8	CG8 Capacidade para aplicar os principios e métodos da calidade.
B9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
C15	CE15 Coñecementos básicos dos sistemas de produción e fabricación.
C17	CE17 Coñecementos aplicados de organización de empresas.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D7	CT7 Capacidade de organizar e planificar.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.
D11	CT11 Planificar cambios que melloren sistemas globais.
D18	CT18 Traballo nun contexto internacional.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
□ Coñecer a base sobre a que apoian as actividades relacionadas con a organización e xestión de a produción.	B8 B9	C15 C17	D1 D2
□ Coñecer o alcance de as distintas actividades relacionadas con a produción.			D7
□ Adquirir unha visión de conxunto para a ejecución de as actividades relacionadas con a organización e xestión de a produción.			D8 D9
□ Realizar unha valoración de os postos de traballo desde un enfoque que axude a o desenvolvemento de as persoas con unha perspectiva de eficiencia e igualdade.			D11 D18

Contidos	
Topic	
PARTE I. CONTORNA ACTUAL E SISTEMAS PRODUTIVOS	1.CONTORNA ACTUAL DA EMPRESA. OS SISTEMAS PRODUTIVOS
PARTE II. PREVISIÓN DE A DEMANDA	2. INTRODUCIÓN. COMPOÑENTES. MÉTODOS DE PREVISIÓN DE A DEMANDA: CUANTITATIVOS E CUALITATIVOS
PARTE III. XESTIÓN DE INVENTARIOS E XESTIÓN DE PRODUCIÓN	3.CONCEPTOS BÁSICOS DE OS INVENTARIOS. CONTROL DE INVENTARIOS 4.XESTIÓN DE INVENTARIOS. MODELOS BÁSICOS
PARTE IV. XESTIÓN DE PRODUCIÓN EN EMPRESAS INDUSTRIAIS	5.PLANIFICACIÓN DE PRODUCIÓN. PLAN AGREGADO. PLAN MESTRE DE PRODUCIÓN 6.PLANIFICACIÓN DE NECESIDADES DE MATERIAIS (MRP) 7.PLANIFICACIÓN DE CAPACIDADE (CRP). PROGRAMACIÓN DE PRODUCIÓN: CRITERIOS E REGRAS BÁSICAS
PARTE V. INTRODUCIÓN AO ESTUDO DO TRABALLO	8.INTRODUCIÓN AO ESTUDO DO TRABALLO. METODOS E TEMPOS. DISTRIBUCIÓN EN PLANTA
PARTE VI. XESTIÓN LEAN	9. A FILOSOFÍA JUST IN TIME (JOT). O ENFOQUE LEAN NA XESTIÓN. ELEMENTOS LEAN

PARTE VII. INTRODUCIÓN Á XESTIÓN DA CALIDADE, A SEGURIDADE E O MEDIO AMBIENTE	10. INTRODUCIÓN Á CALIDADE. EVOLUCIÓN DO ENFOQUE DA CALIDADE. MARCO NORMATIVO. EVOLUCIÓN CARA AO MARCO DA SUSTENTABILIDADE (RESPONSABILIDADE SOCIAL CORPORATIVA, CODIGOS ÉTICOS E ECONOMÍA CIRCULAR)
PRÁCTICAS	1. PREVISIÓN DA DEMANDA 2. CONTROL E XESTIÓN DE INVENTARIOS 3. PLANIFICACIÓN DA PRODUCIÓN I 4. PLANIFICACIÓN DA PRODUCIÓN II 5. LISTAS DE MATERIAIS E OPERACIÓNS 6. PLANIFICACIÓN DA CAPACIDADE 7. PROGRAMACIÓN DA PRODUCIÓN 8. ESTUDO DO TRABALLO. MÉTODOS E TEMPOS

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	64.5	97
Prácticas con apoio das TIC	18	18	36
Exame de preguntas obxectivas	6	6	12
Práctica de laboratorio	2	3	5

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

Metodoloxía docente

	Description
Lección maxistral	Exposición por parte do profesor dos contidos sobre a materia obxecto de estudo, bases teóricas e/ou directrices do traballo, exercicio ou proxecto a desenvolver polo estudante.
Prácticas con apoio das TIC	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedimentales relacionadas coa materia obxecto de estudo. Desenvólvense en espazos especiais con equipamento adecuado.

Atención personalizada

Methodologies	Description
Lección maxistral	Exposición por parte do profesorado de contidos sobre a materia dunha maneira máis específica. Para todas as modalidades de docencia, as sesións de tutorización poderán realizarse por medios telemáticos (correo electrónico, videoconferencia, foros de Moovi) baixo a modalidade de concertación previa.
Prácticas con apoio das TIC	Explícanse as dúbidas nos exercicios de forma individualizada. As sesións de tutorización poderán realizarse por medios telemáticos (correo electrónico, videoconferencia, foros de Moovi,...) baixo a modalidade de concertación previa.

Avaliación

	Description	Qualification	Training and Learning Results
Exame de preguntas obxectivas	2 Teórico-Prácticas de igual peso: Probas de avaliación continua que se realizarán a o longo do curso, nas clases de teoría e/o nas datas habilitadas polo Centro, 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	B8 C15 D1 B9 C17 D2 D7 D8 D9 D18
Práctica de laboratorio	1 Exercicios de prácticas: Proba de avaliación continua que terá lugar unha vez realizadas todas as sesións prácticas, de acordo con a planificación académica, na data recollida no calendario oficial do Centro para os exames da primeira oportunidade.	40	B8 C15 D1 B9 C17 D2 D7 D8 D9 D18

Other comments on the Evaluation

COMPROMISO ÉTICO.

Espérase que o alumno presente un comportamento ético adecuado. En cáso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0). Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo

autorización expresa. O feito de introducir un dispositivo electrónico non autorizado 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)

AVALIACIÓN CONTINUA (cualificación sobre 10).

Todo o alumnado, salvo aquelas persoas que se acollan á Avaliación Global nos prazos establecidos polo Centro, será avaliado mediante a modalidade de Avaliación Continua.

Para superar a materia por Avaliación Continua deben cumprirse os seguintes puntos:
1. É imprescindible realizar con aproveitamento as prácticas da materia asistindo ás mesmas e entregando a resolución dos exercicios propostos e desenvolvidos nas sesións de prácticas. Só se permitirán por causas debidamente xustificadas, 2 faltas a o longo de todo o curso, debéndose entregar a resolución dos exercicios ou do traballo equivalente para súa recuperación. Unha vez superado o tope das 2 faltas non se poderá aprobar a materia por avaliación continua.
Importante**:** O comportamento inadecuado nas clases penalizarase coma se fose unha falta. De igual maneira, se o traballo da práctica entrégase fóra dos prazos establecidos, esta contabilizarase como unha práctica non realizada.
2. Débense superar todas as probas (2 teórico-prácticas e 1 de exercicios) ou ben ter unha media de aprobado e que ningunha das notas das diferentes partes sexa inferior ao 4 (nota mínima para compensar)
O alumnado que supere a materia por Avaliación Continua poderá presentarse, no caso de que queira optar a maior nota nalgunha das partes teórico-prácticas, á proba da primeira oportunidade da convocatoria oficial da materia, establecida o calendario oficial de exames do Centro. É importante saber que para a nota final teranse en conta as notas de todas as probas realizadas.
O alumnado que non supere a materia por Avaliación Continua por non alcanzar o aprobado ou a nota mínima para compensar nunha das dúas partes teórico-prácticas da materia, poderá recuperar esta parte na proba final correspondente á primeira oportunidade da materia e fixada no calendario oficial de exames do Centro.
Finalmente, unha vez realizado o exame da primeira oportunidade, de non superarse a materia por Avaliación Continua, a proba correspondente da segunda oportunidade da convocatoria oficial (Julio) comprenderá todas as partes da materia.

CONVOCATORIAS OFICIAIS (cualificación sobre 10).
O alumnado que renunciase á Avaliación Continua será avaliado mediante a modalidade de Avaliación Global, podendo optar á máxima cualificación.
Dentro da Avaliación Global contémplanse dúas situacións:a) Aquel alumnado que desenvolvese con aproveitamento as prácticas (é dicir, que asista e entregue a resolución das mesmas nos prazos establecidos), realizará unha proba cun parte teórico-práctica (60% da nota) e outra de exercicios de prácticas "reducida" (40% da nota).b) Aquel alumnado que non cumpra a condición das prácticas, realizará unha proba cunha parte teórico-práctica (60% da nota) e outra de exercicios de prácticas "ampliada" (40% da nota).

CUALIFICACIÓN FINAL.

A nota final do alumno calcularase a partir das notas das distintas probas tendo en conta a ponderación destas: partes teórico-prácticas 60% e parte de exercicios de prácticas 40%. En calquera caso, para superar a materia é condición necesaria superar todas a partes ou ben ter unha media de aprobado sen que ningunha das notas sexa inferior a 4 (nota mínima para compensar).

Nos casos nos que a nota media das diferentes partes sexa igual ou superior ao valor do aprobado, pero nalgunha das partes non se alcanzou o valor mínimo de 4, a cualificación final será de suspenso. A modo de exemplo, un alumno que obtivese as seguintes cualificacións: 5, 9 e 1 estaría suspenso, aínda cando a nota media dá un valor igual o maior que 5, ao ter unha das partes por baixo da nota de mínima esixida (4). Nestes casos, a nota que se reflectirá na acta será de suspenso (4).

Bibliografía. Fontes de información
Basic Bibliography
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Complementary Bibliography
Krajewski, Ritzman y Malhotra, **Administración de Operaciones. Procesos y cadena de suministro**, Pearson, 2013
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Rajadell, M., **Lean Manufacturing. Herramientas para producir mejor**, Díaz de Santos, 2021
Larrañeta, J.C., Onieva, L. y Lozano, S., **Métodos Modernos de gestión de la Producción**, Alianza Editorial, 1995

Recomendacións

Other comments

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

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

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

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C11	CE11 Knowledge of the fundamentals of electronics.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Know the operation of the electronic devices.	B3	C11	D2 D9 D10
Know the electronic systems of conditioning and acquisition of data.		C11	D10
Identify the different types of industrial sensors.			D10
Know the digital electronic systems basic.		C11	D2 D9 D17
Know the electronic circuits for the communication of information.	B3		D10

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	Training and Learning	Results
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	C11	D9 D10 D17
Objective questions exam	Several individual tests will be carried out referring to a set of subjects of the subject. None of the tests carried out will have a weight greater than 40% in the total grade for the subject.	80	B3 C11	D2 D9 D10
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. This test is reserved for those students who do not reach a minimum score in the "Objective question exams" or those who have been recognized by the center as waiving continuous assessment.	80	B3 C11	D2 D9 D10

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

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	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Diéguez Quintas, José Luís			
Lecturers	Álvarez Feijoo, Miguel Ángel Diéguez Quintas, José Luís Fenollera Bolíbar, María Inmaculada Queimaño Piñeiro, David			
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.			

Training and Learning Results
Code

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

Contents	
Topic	
DIDACTIC UNIT 1. INTRODUCTION To THE TECHNOLOGIES And SYSTEMS OF MANUFACTURE.	Lesson 1. INTRODUCTION TO MANUFACTURING ENGINEERING. The production cycle. Classification of industries. Manufacturing technologies.

DIDACTIC UNIT 2. METROTECHNICS.	Lesson 2. PRINCIPLES OF DIMENSIONAL METROLOGY. Introduction. Definitions and concepts. The international system of units. Physical quantities covered by Dimensional Metrology. Elements involved in the measurement. Classifications of measurement methods. Patterns. The traceability chain. Calibration. Uncertainty. Calibration chain and transmission of uncertainty. Relationship between tolerance and uncertainty. Expression of measurement uncertainty in calibration. Lesson 3. MEASUREMENT INSTRUMENTS AND METHODS. Introduction. Patterns. Verification instruments. Interferometric patterns. Principles of interferometry. Direct measurement instruments. Methods and instruments of indirect measurement. Lesson 4. MEASUREMENT BY COORDINATES. IMAGE MEASUREMENT. SURFACE QUALITY. Coordinate measuring machines. Concept. Principles of MMC. Classification of machines. Main components of MMC. Process to follow for the development of a measure. Image measurement systems. Surface Quality. Roughness measurement methods. Roughness parameters.
DIDACTIC UNIT 3. FORMING PROCESSES BY MATERIAL REMOVAL	Lesson 5. INTRODUCTION TO SHAPING BY MATERIAL REMOVAL. Introduction. Movements in the material removal process. Factors to take into account when choosing the tool. Tool geometry. Tool materials. Chip formation mechanism. Types of chips. Power and cutting forces. Tool wear. Tool wear criteria. Determination of tool life. Cutting fluids. Lesson 6. TURNING: OPERATIONS, MACHINES AND TOOLS. Introduction. Main operations around. The machine tool: the lathe. Main parts of the lathe. Assembly or holding of parts. Typical lathe tools. Special lathes. Lesson 7. MILLING: OPERATIONS, MACHINES AND TOOLS. Introduction. Description and classification of milling operations. Parts and main types of milling machines. Types of strawberries. Tool assembly. Piece clamping. Different configurations of milling machines. Special milling machines. Lesson 8. MACHINING OF HOLES AND WITH MAIN RECTILINEAR MOVEMENT: OPERATIONS, MACHINES AND TOOLS. Introduction to hole machining operations. Drilling machines. Boring machines. General characteristics of machining processes with main rectilinear movement. Filer. Mortiser. Planer. Broaching machine. Saws. Lesson 9. SHAPING WITH ABRASIVES: OPERATIONS, MACHINES AND TOOLS. Introduction to hole machining operations. Abrasive wheels. Grinding operation. Types of grinding machines. Honed. Lapped. Polished. Burnish. Super finish Lesson 10. NON-CONVENTIONAL MACHINING PROCESSES. Introduction. Machining by electro-erosion or electro-discharge. Electrochemical machining. Laser machining. Water jet machining. Plasma arc cutting. Ultrasonic machining. Chemical milling.
DIDACTIC UNIT 4. AUTOMATION AND MANAGEMENT OF MANUFACTURING PROCESSES.	Lesson 11. NUMERICAL CONTROL OF MACHINE TOOLS. Introduction. Advantages of the application of NC in machine tools. Information needed to create a NC program. Manual programming of MHCN. Types of CN language. Structure of a program in ISO code. Characters used. Preparatory functions (G__). Auxiliary functions (M__). Interpretation of the main functions. Examples. Automatic programming in numerical control.

DIDACTIC UNIT 5. PROCESSES FOR SHAPING MATERIALS IN LIQUID AND GRANULAR STATES.	Lesson 12. GENERAL ASPECTS OF METAL CASTING FORMING. Introduction. Stages in casting forming. Nomenclature of the main parts of the mold. Materials used in casting. Fluid flow in the feeding system. Solidification of metals. Contraction of metals. The suck. Calculation procedure for the casting distribution system. Considerations on design and defects in cast parts. Lesson 13. FOUNDRY MANUFACTURING PROCESSES. Classification of foundry processes. Sand molding. Shell molding. Plaster molding. Ceramic molding. CO2 molding. Lost wax molding Full mold casting. Merccast molding. Molding in permanent mold. Injected casting. Centrifugal casting. Furnaces used in foundry. Lesson 14. POWDER METALLURGY (POWDER METALLURGY). Introduction. Manufacturing of metal powders. Characteristics and properties of metal powders. Dosing and mixing of metal powders. Compaction. Sintered. Sintering furnaces. Disruptive discharge sintering. Presintered. Subsequent operations. Design considerations. Products obtainable by sintering. Lesson 15. SHAPING OF PLASTICS. Introduction. Classification of polymeric materials. Physical properties of polymers. Classification of processes. Extrusion molding. Injection molding. Compression molding. Transfer molding. Rotational molding. Thermoforming.
DIDACTIC UNIT 6. UNION SHAPING PROCESSES.	Lesson 16. WELDING PROCESSES. Introduction to welding processes. Electric arc welding. Resistance welding. Welding with oxygen and fuel gas. Welding with the melting temperature of the filler metal lower than that of the metals to be joined. Lesson 17. JOINNING AND ASSEMBLY PROCESSES WITHOUT WELDING. Bonding processes using adhesives. Adhesion resistance. Conditions for gluing. Joint design Types of adhesives according to origin and composition. Mechanical joining processes. Removable and permanent mechanical joints.
DIDACTIC UNIT 7. FORMING PROCESSES BY PLASTIC DEFORMATION OF METALS.	Lesson 18. GENERAL ASPECTS OF FORMING BY PLASTIC DEFORMATION. Introduction. Stress-strain curves. Expressions of deformation. Volume constancy. Approximate models of the real stress-natural deformation curve. Plane strain state. Primary and secondary processes. Hot and cold work processes. Conditions and process control. Lesson 19. LAMINATION AND FORGING PROCESSES. Lamination: basics; lamination temperature; hot rolling equipment; characteristics, quality and tolerances of hot rolled products; cold rolling. Forging: free; in printing matrix; in press; by stressing; cold heading; by lamination; in cold. Lesson 20. EXTRUSION, DRAWING AND RELATED. Extrusion. Stretching of bars and tubes. Wire drawing. Section reduction. Embossing. Embossed around. Pieces made by embossing: design considerations. Stretch forming. Forming with rubber pads and pressurized liquid. High power shaping. Lesson 21. SHEET METAL SHAPING. Curving or bending of sheets. Curved with rollers. Formed with rollers. Straightened. Snapped. Sheet metal cutting operations.

PRACTICE PROGRAM	Practice 1.- Use of conventional metrology devices. Measurement of pieces using a normal caliper, depth gauge, exterior and interior micrometer. Use of dial gauge. Checking flat surfaces. Use of go/no go gauges, rules, squares and pattern cleats. Measuring and checking threads. Making metric measurements and in English units. Practice 2.-Indirect measurements. Checking a cone using rollers and a caliper, measuring a dovetail using rollers, measuring the angles of a double dovetail and measuring using a sine ruler. Direct measurements with goniometer. Checking threads. Practice 3.- Coordinate measurement machine. Coordinate system selection. Checking part measurements, using a coordinate measuring machine. Verification of tolerances, shape and position. Practice 4.- Manufacturing with conventional machine tools. Manufacture of a part using the conventional lathe, milling machine and drill, defining the basic operations and carrying them out on the machine. Manufacturing process planning. Preparation of process sheets. Practice 5, 6 and 7.- Introduction to numerical control applied to the lathe and milling machine. Realization of a CNC program using a simulator, with the main and simplest commands. Programming and machining of parts on both the lathe and the milling machine in the workshop classroom. Practice 8.- Welding. Knowledge of different electric welding equipment. Welding of different materials using coated electrode, TIG and MIG techniques. Practice 9.- Scoring practical test on numerical control.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	0	32.5
Laboratory practical	18	0	18
Objective questions exam	1	0	1
Objective questions exam	1	0	1
Laboratory practice	2	0	2
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	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	Classes of theory in classroom
Laboratory practical	Practices of laboratory by groups

Assessment			
	Description	Qualification	Training and Learning Results
Objective questions exam	EX1 (tests continuous evaluation - 36% final note-) Tests written and face-to-face to make to half of course on the contents from the start until this moment. Compulsory character. It will be composed by 12 ask type test on the practical theoretical/contents of the matter. The note of this test will obtain adding 0,3 points by each properly answered question and will subtract 0,1 points if the question is resolved of wrong form. The questions in white do not mark, but only can leave 4 questions in white.	36	
Objective questions exam	EX2 (tests continuous evaluation - 39% final note-) Tests written and face-to-face to make to final of course on the contents from half of course to the end. Compulsory character. It will be composed by 13 ask type test on the practical theoretical/contents of the matter. The note of this test will obtain adding 0,3 points by each properly answered question and will subtract 0,1 points if the question is resolved of wrong form. The questions in white do not mark, but only can leave 4 questions in white.	39	
Laboratory practice	*CNC (Tests continuous evaluation - 15% final note-): A proof to make in the schedule of consistent practical class in the realisation of a program of numerical control that mechanise the piece that present him .	15	
Case studies	*MEM (Tests continuous evaluation - 10% final note-): A proof written, work or memory to propose by the professor along the *cuatrimestre. This proof will value with a maximum of 1 point, 10% of the final note.	10	

Other comments on the Evaluation

APPROVED

Students qualified through continuous evaluation:

To pass this subject it is necessary to obtain at least 5 points by adding the score of the EX1, EX2, CNC and MEM type tests under the conditions set out above.

If more than 4 questions are left blank in the EX1 or EX2 tests, the score in that test will be 0.

In principle, all students must follow the continuous evaluation procedure, except for those who expressly resign within the time and manner and are granted the resignation by the school.

Qualified students with waiver granted to continuous evaluation:

To pass this subject it is necessary to obtain at least 5 points by adding the scores of the EXA and REC type tests, under the following conditions:

EXA (theoretical/practical exam waiver of continuous evaluation - 75% final grade)

Written and in-person test to be taken on the entirety.

It will be composed of 25 multiple choice questions on the theoretical/practical contents of the entire 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 subtracted if the question is answered incorrectly. Blank questions do not count, but only 8 questions can be left blank.

PRA (practical exam waiver of continuous evaluation - 25% final grade)

Written resolution of several practical problems, the value of which will be 25% of the final grade. It is necessary to obtain a minimum of 1 point in this test so that the grade can be added to that of the EXA test and to be able to obtain at least 5 points to pass the subject.

These tests will be carried out exclusively by students who have been granted a waiver from continuous evaluation, and will be carried out on the day set by the center for the 1st opportunity evaluation.

ATTENDANCE TO THEORETICAL AND PRACTICAL CLASSES

Attendance at theoretical and practical classes is not mandatory, but what is taught in them will always be the subject of the

exam.

EXTRAORDINARY CALL (Minutes of 2nd edition / July)

Students qualified through continuous evaluation:

This second edition of the ordinary call will be qualified as follows:

- By taking the mandatory EXA type test.

EXA (theoretical/practical exam waiver of continuous evaluation - 75% final grade)

Written and in-person test to be taken on the entirety. It will be composed of 25 multiple choice questions on the theoretical/practical contents of the entire 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 subtracted if the question is answered incorrectly. Blank questions do not count, but only 8 questions can be left blank.

- The grades of the CNC and MEM continuous evaluation tests are maintained in this 2nd opportunity, but you can, if you wish, improve this grade:

CNC: by carrying out a new machine tool programming test, which will be a test, at the end of the 2nd edition EXA test.

MEM: through a new written test, work or report, which will be similar, to be delivered on the date it is published, before the day of the call for 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 minimums as in the 1st edition.

The grades of the continuous assessment tests will not be kept from one course to another.

Qualified students with waiver granted to continuous evaluation:

Students who do not take continuous evaluation, because the center has accepted their resignation, must always take the EXA type test and the PRA type test in all calls, in the terms specified for the first opportunity.

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

EXTRAORDINARY FINAL CAREER CALL:

This test will be the same for all students and will consist of an EXA type test and a PRA type test, in the terms specified in the previous sections for students who have waived continuous evaluation.

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

ETHICAL COMMITMENT:

The student is expected to present appropriate ethical behavior, free of fraud. If unethical behavior is detected (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 enroll in this subject it is necessary to have passed or be enrolled in all the subjects of the courses lower than the course to which this subject is located.

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

IDENTIFYING DATA				
Fluid mechanics				
Subject	Fluid mechanics			
Code	V12G363V01403			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	English			
Department				
Coordinator	Gil Pereira, Christian			
Lecturers	Gil Pereira, Christian			
E-mail	chgil@uvigo.es			
Web				
General description	This syllabus presents information the Fluid mechanics course that belongs to the 2nd year, 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.			

Training and Learning Results	
Code	
B4	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.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
C8	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.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
Knowledge for the realisation of measurements, calculations, assessments, evaluations, studies, reports, plans of works and other analogous works	B4 B5	C8	D2 D9 D10
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	B4 B5	C8	D2 D9 D10
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	B4 B5	C8	D2 D9 D10
Resolution of problems	B4 B5	C8	D2 D9 D10

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
Laboratory practice	3.6	0	3.6
Essay questions exam	1.5	0	1.5
Essay questions exam	1.5	0	1.5
Essay questions exam	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
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	Training and Learning Results
Laboratory practice	Submission of a report/questionnaire and/or oral examination of at least one experimental/IT practice to be carried out throughout the course.	10	B4 C8 D2 B5 D9 D10
Essay questions exam	First partial test of continuous evaluation, weight: 25%. Test consisting of theoretical/practical questions, including problem-solving and/or a topic to develop. It may include multiple-choice questionnaires.	25	B4 C8 D2 B5 D9 D10
Essay questions exam	Second partial test of continuous evaluation, weight: 25%. Test consisting of theoretical/practical questions, including problem-solving and/or a topic to develop. It may include multiple-choice questionnaires.	25	B4 C8 D2 B5 D9 D10
Essay questions exam	Final test of continuous evaluation (retest), weight: 40%. Test consisting of theoretical/practical questions, including problem-solving and/or a topic to develop. It may include multiple-choice questionnaires.	40	B4 C8 D2 B5 D9 D10

Other comments on the Evaluation

The student will be able to freely choose the evaluation methodology (Global or Continuous) within the established deadline and procedure set by the school or the subject coordinator, and in any case in accordance with current regulations.

Two grades will be calculated for each student, and the higher of the two will be selected:
Final Grade = max {0.6 NC + 0.4 NF , NF + (1/30)NC(10 - NF)} where NC is the average of the two continuous evaluation tests (in the range of 0 to 10) and NF is the grade of the final exam (also out of 10).
Global Evaluation Mode A final exam will be held on the official date approved by the school, with a maximum score of 100%.**Second opportunity call In the second opportunity call (extraordinary in July), the same methodology as in the first opportunity will apply, with a new final evaluation test for students who choose continuous evaluation and a new final exam for those following the global evaluation. In the continuous evaluation mode, therefore, the grades of the partial tests and practical work are retained.**
In case of not attending any final exam/retest, the student will received a grade of "Absent" unless the student had followed the continuous assessment and express the will to received the corresponding grade.

The studentis expected to exhibit adequate ethical behaviour. In case of noticing anon-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 course. In this case, the globalqualification of the present academic course will be failed (0.0). The use ofany electronic device during the evaluation tests will not be allowed unlessexpressly authorized. The fact of introducing an electronic device notauthorized in the exam room will be considered a reason for not passing thesubject 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	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Riveiro Rodríguez, Belén			
Lecturers	Riveiro Rodríguez, Belén			
E-mail	belenriveiro@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	(*)Nesta materia estúdiase o comportamento dos sólidos deformables, analizando as relacións entre solicitacións, tensións e deformacións. Estúdianse os principios básicos da Resistencia de Materiais, especialmente en elementos tipo barra.			

Training and Learning Results
Code

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

Contents	
Topic	
1. Introduction of concepts of mechanics needed for the study of mechanics of materials	1.1 Vectors. Scalar product and cross product of two vectors 1.2 Types of connections 1.3 Moment of a force 1.4 Static equilibrium 1.5 Elements subjected to 2 or more forces 1.6 Distributed forces and centroids of area 1.7 Reduction of a system of forces to one force-couple 1.8 Frames and machines. Trusses. 1.9 Moments and products of inertia
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. Buckling	4.1. Fundaments of buckling
5. Bending and shear	5.1 Beams: definition and types. Loads on beams. 5.2 Internal shear forces and bending moments. 5.3 External load, shear force and bending moment relationships. 5.4 Shear and moment diagrams 5.5 Pure bending and non-uniform bending. Hypothesis and limitations. 5.6. Normal stresses in unsymmetric bending. 5.7 Symmetric bending. The flexure formula (Navier's Law). 5.8 Section modulus of a beam. Ideal beam cross-section. 5.9 Deflection of beams and shafts. Slope and deflection. 5.10 Hyperstatic bending.
6. Other forces	6.1. Fundamentals of shear 6.4. Fundamentals of torsion

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30.5	40	70.5
Laboratory practical	9	23	32
Problem solving	9	9	18
Essay questions exam	3	0	3
Problem and/or exercise solving	0	24.5	24.5
Objective questions exam	2	0	2

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

Methodologies

	Description
Lecturing	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.
Problem solving	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	Training and Learning Results
Laboratory practical	Attendance and active participation in all the practical classes of the semester will be valued, as well as the timely delivery of all the documentation requested in them (reports, internship reports, etc.). The face-to-face part corresponding to each practice takes place on a specific date, so it is not possible to make up for absences. Those practices in which the student presents an official certificate (doctor, court,...) due to unavoidable reasons will be excused. It will be scored with the indicated value, provided that at least 45% of the possible qualification is reached in the final exam.	10	
Essay questions exam	Written exam on the official data established by the School. Minimum mark to sum in the final mark is 45% (*) (*) This minimum will be reduced to 40% for students who have attended and actively participated in at least 80% of the activities during lectures	40	
Problem and/or exercise solving	Throughout the course, 4 problem/exercise bulletins will be established for students to solve independently. These reports must be handed in solved on dates established by the teaching staff of the subject at the beginning of the course. The delivery must be made only through the teleteaching platform.	10	
Objective questions exam	Written tests to assess the individual work done by the student throughout the course. 4 tests will be carried out throughout the course on the dates that will be communicated to the students as the course progresses. Each test will be valued at 10% of the overall grade for the subject, with the total of tests valued at 40% of the final grade. To pass the subject, it will be a necessary condition to achieve at least 40% of the mark of this test. Students who do not reach this minimum (40%) may only pass the course through the extraordinary exam (second opportunity under the global assessment modality). The indicated value will be scored, provided that at least 45% (*) of the possible grade is reached in the final exam. (*) This minimum will be reduced to 40% for students who have attended and actively participated in at least 80% of the activities during lectures. Students who opt for the global assessment modality (waiving continuous assessment) will take a final exam consisting of: i) developmental questions; ii) questions of a conceptual nature (presumably test-type). This final exam will be assessed with 100% of the final grade of the subject (60% problem-solving section; 40% questionnaire).	40	

Other comments on the Evaluation

Ethical Commitment: The student is expected to demonstrate appropriate ethical behavior. If unethical behavior is detected

(copying, plagiarism, use of unauthorized electronic devices and others), they consider that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade of this course will be suspended (0.0).
The use of any electronic device will not be allowed during the assessment tests unless expressly authorized. The fact of introducing an unauthorized electronic device into the exam room will be considered a reason for not passing the subject in this academic year and the overall grade (0.0) will be suspended.
In case of discrepancies between the different translations of this document, Galician version will be taking into account.

Sources of information

Basic Bibliography

Manuel Vázquez, **Resistencia de materiales**,

Complementary Bibliography

Hibbeler, R., **Mecánica de materiales**,
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 enroll in the subject, it is necessary to have passed or be enrolled in all the subjects of the courses below the course in which this subject is scheduled.

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	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Morán González, Jorge Carlos			
Lecturers	Diz Montero, Rubén Morán González, Jorge Carlos			
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.			

Resultados de Formación e Aprendizaxe	
Code	
B4	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.
B5	CG5 Coñecementos para a realización de medicións, cálculos, valoracións, taxacións, peritaxes, estudos, informes, planes de labores e outros traballos análogos.
B6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
B7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
B11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
C7	CE7 Coñecementos de termodinámica aplicada e transmisión de calor. Principios básicos e a súa aplicación á resolución de problemas de enxeñaría.
D2	CT2 Resolución de problemas.
D7	CT7 Capacidade de organizar e planificar.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Capacidade para coñecer, entender e utilizar os *prinicpios e fundamentos da termodinámica aplicada	B5 B6 B7	C7	D2 D7 D9 D10 D17

Capacidade para coñecer e *entendr o principio e fundamentos da *transmision da calor	B5 B6 B7 B11	C7	D2 D7 D9 D17
Capacidade para coñecer e entender os principios e fundamentos de equipos e xeradores térmicos	B4 B5 B6 B7	C7	D2 D7 D9 D10 D17
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	B4 B5 B6 B7 B11	C7	D2 D7 D9 D17

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

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

Metodoloxía docente	
	Description
Lección maxistral	Exposición por parte do profesor dos contidos da materia obxecto de estudo, onde se procurará a máxima participación do alumno, a través da súa implicación directa na formulación de cuestións e/ou problemas,
Prácticas de laboratorio	Experimentación de procesos reais en laboratorio e que complementan os contidos que se imparten na materia
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno levará a cabo mediante a consulta da bibliografía
Resolución de problemas	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno realizará en aula e/ou laboratorio. Resolveranse problemas de carácter "tipo" e/ou exemplos prácticos. Salientarase o traballo en expor métodos de resolución e non nos resultados.

Atención personalizada

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

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas e/ou exercicios	Consistirá na realización de distintos exercicios ao longo do período lectivo aprobado polo centro, consistente na resolución de problemas de resposta extensa, ou exercicios e/ou cuestións teóricas, relativos aos contidos da materia desenvolvida en tempo/condicións establecido/as polo profesor. Cada unha destas actividades non superará o 40% da cualificación final da materia. Os alumnos deben desenvolver, relacionar, organizar, xustificar e presentar os coñecementos que teñen sobre os contidos da materia en respostas argumentadas. Resultados de aprendizaxe: Capacidade para coñecer, entender e utilizar os principios e fundamentos da termodinámica aplicada e a transmisión de calor, argumentando as solucións propostas	70- 80	B4 B5 B6 B7	C7	D2 D7 D9 D10
Exame de preguntas obxectivas	Ao longo do período lectivo realizaranse varias actividades baseadas en probas escritas ou orais de resposta curta. Resultados de aprendizaxe: Capacidade para comprender, comunicar e transmitir coñecementos, habilidades e destrezas no campo da termodinámica aplicada e a transmisión de calor	20-30	B6	C7	D2 D7 D9 D10

Other comments on the Evaluation

Todos os días lectivos consideraranse probables e susceptibles de incluír algunha actividade de avaliación continua. Estas actividades serán notificadas con suficiente antelación, e realizaranse dentro do horario lectivo aprobado polo centro, durante as sesións en aula e/ou sesións de problemas e/ou laboratorio que teñen lugar ao longo do curso. Caso de insuficiencia de medios, o profesorado articulará o mecanismo de planificación que garanta o mellor axuste ao horario.

Rexerase a realización destas actividades avaliación continua en tempo/condicións establecido/as polo profesor.

Modalidade de Avaluación Global.

O alumnado que o seu elección sexa a modalidade de avaliación global deberá obter oficialmente a renuncia á modalidade de avaliación continua, utilizando as canles previstas pola escola, e será avaliado dentro do prazo de probas oficiais (dúas oportunidades de avaliación do curso) marcado no calendario académico do curso nas datas oficiais fixadas polo centro.

Esta modalidade de avaliación global tendrá en conta todos os contidos impartidos na materia, tanto os que impartiron as clases docentes de teoría, sesións de problemas e prácticas de laboratorio, e suporá o 100% da nota máxima.

Constará de dous partes:

1.- Proba escrita consistente na resolución de problemas de resposta extensa, relativos aos contidos da materia desenvolvida e en tempo/condicións establecido/as polo profesor,e onde os alumnos deben desenvolver, relacionar, organizar, xustificar e presentar os coñecementos que teñen sobre os contidos da materia a través de respostas argumentadas. O peso sobre a cualificación final será do 70-80%

2.- Unha proba específica que incluirá tanto os contidos impartidos nas sesións de teoría como das sesións prácticas de laboratorio. Consistirá en cuestións teóricas e/ou realización dunha proba test de preguntas onde o alumno deberá transmitir os coñecementos, habilidades e destrezas relativos aos contidos teóricos da materia. Non se permitirá ningunha clase de formulario ou similar, nin calculadora nesta proba específica. O peso sobre a cualificación final será do 20-30%.

Calquera evidencia deste tipo de proba, escrita e/ou específica, considerararanse avaluable e se lles tendrá en conta para a cualificación final.

Criterios de cualificación

En todo caso, é necesario obter unha nota final igual ou superior a 5 puntos para superar a materia, en calquera das dúas oportunidades de avaliación (ordinaria e extraordinaria).

O alumnado deberá xustificar ou argumentar todos os resultados que se propoñan nas solucións propostas nos problemas de resposta longa. Non se dará ningún resultado por "sobreentendido" e terase en conta o desenvolvemento explicativo utilizado para chegar á solución proposta.

Na oportunidade de avaliación ordinaria, a cualificación do alumnado (CF), seguindo a modalidade de avaliación continua, calcularase sumando as diferentes notas obtidas nas sucesivas actividades de avaliación continua. Se a súa elección é a modalidade de avaliación global, a nota do alumno (CF) determinarase considerando a suma das notas da parte da proba escrita e da específica.

O alumnado que non superase a materia en á oportunidade ordinaria, en á oportunidade extraordinaria de avaliación, será avaliado sobre todos os contidos impartidos na materia, tanto os impartidos nas clases teóricas como nas sesións de problemas e nas prácticas de laboratorio, e terá unha puntuación de 100 % da nota máxima.

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

CONVOCATORIA DE FIN DE CARREIRA:

poderán ter un formato de exame distinto ao detallado anteriormente. Realizarase mediante un exame escrito no que se abordarán os aspectos máis relevantes da materia, tanto en cuestións teóricas como mediante problemas de resolución numérica que permitirán obter o 100% da avaliación e deberá ser un mínimo do 50%. chegou a superar o tema

Todas as probas deberán realizarse con bolígrafo ou bolígrafo, preferentemente azul. Non se permitirá a entrega destas probas a lapis ou bolígrafo vermello. Non se permitirá o uso de dispositivos electrónicos como tabletas, teléfonos intelixentes, reloxos intelixentes, portátiles, etc. en todas as probas, xa sexan de avaliación continua ou de avaliación global. ou dispositivos similares non autorizados

Compromiso ético.

Espérase que o alumnado presente un comportamento ético adecuado. No caso de detectarse comportamentos pouco éticos (copia, plaxio, uso de dispositivos electrónicos non autorizados, etc.), considerarase que o alumnado non reúne os requisitos necesarios para superar a materia. Neste caso, a nota global deste curso académico será de suspenso (0,0).

Non se permitirá o uso de ningún dispositivo electrónico durante as probas de avaliación, salvo autorización expresa. O feito de introducir na aula de exames un dispositivo electrónico non autorizado terá a consideración de motivo de non superación da materia neste curso académico e a nota global será suspensa (0,0).

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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

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

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

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

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

IDENTIFYING DATA				
Applied electrotechnics				
Subject	Applied electrotechnics			
Code	V12G363V01501			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	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			

Training and Learning Results
Code

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

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 have to create groups to find out the solutions to the 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 of the session
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	Training and Learning Results
Lecturing	It will cover 30 of the mark . It wiil be about power transformers The student has to obtain a mark bigger than the 30% of the value of this part in order to compensate with the other part of the subject.	30	
Problem solving	First part : 3-ph systems (40%) Second part: Transformers (20%) The student has to obtain a mark bigger than the 30% of the value of this part in order to compensate with the other part of the subject.	60	
Laboratory practical	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	Choose	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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
C19	CE19 Knowledge and skills for engineering materials.
D1	CT1 Analysis and synthesis.
D5	CT5 Information Management.
D7	CT7 Ability to organize and plan.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D15	CT15 Objectification, identification and organization.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Knowledge of the main manufacturing and transformation processes used in the industry	B3	C19	D1
Probe the ability to select the most suitable forming process for each material	B4		D5
Knowledge of the joining processes used in the industry	B5		D7
Understand the complex relations between the properties of materials and the forming and joining processes in order to improve properties and to increase productivity	B6		D9
	B11		D10
Knowledge of the characteristics of the materials used in engineering			D15
Knowledge of the several types of materials and processes for their forming			D17
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	Personalised attention, time devoted to help students with any difficulty or doubt. This support can be provided either in person or electronically (email, video-conference, campus remoto ...) after being formally requested.

Assessment

	Description	Qualification	Training and Learning Results	
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 learning period (30%) and the other in the date established by the administration (40%)	70	B3 B4 B5 B6 B11	D5 D7 D9 D10 D15
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 learning period	20		D5 D9 D10 D15 D17
Mentored work	It will be assessed by the handed reports and/or the exposition in the classroom of the prepared project.	10	B3 B4 B11	D9 D10 D15

Other comments on the Evaluation

FIRST ATTEMPT:

a) Option 1: continuous evaluation

The continuous assessment will be conducted during the learning process (teaching period of the subject) according to the criteria established in the previous section. The contribution of each item to the final score is as follows:

1) Laboratory work (20%). The contents worked in the laboratory will be assessed with an exam, that will be taken at the end of the semester in a date agreed with the students. In addition, the attendance to the laboratory sessions as well as the preparation of reports will be considered.

2) Preparation and presentation of a project (10%).

3) Mid-term exam including some of the contents explained in the classroom (30%). This exam will be taken in November.

4) Final exam including the remaining contents (those not included in the mid-term exam, 40%). This exam will be taken in the data officially established by the administration.

To pass this subject a minimum mark of 5, out of 10, is required, that will compile the sum of each item. In addition, a **minimum score, 40%**, is required in each written exam (mid-term and final) to pass the subject under the continuous evaluation plan. In case this **minimum score was not achieved in the mid-term exam and/or in the final exam**, the student could pass whether the **sum of both marks** is, at least, **3.5** (50% of the total mark, that is 7), provided that the sum of the marks in the above listed items is above 5.

In case these **minimum scores were not achieved**, the score achieved in items 1) and 2) will not be considered in the total grading.

b) Option 2: comprehensive evaluation Students have the right to renounce to the continuous assessment system. This option must be formally asked within the period established by the lecturer and informed at the beginning of the course. In this situation, a comprehensive final exam will be taken which includes the entirety of the contents of the subject (laboratory and theory), and its weight is 100%. The minimum score to pass it is 5 out of 10. The date of the exam will be fixed by the administration and can be checked at http://eei.uvigo.es.

SECOND ATTEMPT (exam in July):a) The score partially obtained from the continuous assessment option (items 1) and 2)) will be kept unless the student requests to be cancelled in due course (once cancelled student will be evaluated as described in b)). The exam will cover uniquely the contents explained in the classroom. The weight of this exam in the grading will be 70%. The same minimum requirements as those indicated in Option 1 will be considered. The final grading will be the sum of the mark in this exam and the marks obtained in items 1) and 2), in case the minimum scores had been

achieved. b)Under the comprehensive assessment system, 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 grading (the minimum mark to pass the exam will be 5 out of 10). The date of the exam will be fixed by the administration 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 fraudulent behaviour is detected (copy, plagiarism, use of forbidden electronic devices, or others), the student will fail and its final score will be 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	Choose	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).			

Training and Learning Results	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
C2	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.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
To know and to understand the physical foundations of electricity and magnetism as well as of vibrations and waves.	B10	C2	
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.	B10	C2	
To be able to establish efficient strategies and procedures for solving problems in fundamentals of physics related to industrial technologies.	B10	C2	
To be able to implement specific solutions in the laboratory to experimental problems in fundamentals of physics.	B10	C2	D10

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

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	Training and Learning Results
Essay questions exam	Tests that includes open questions on a topic. Students should develop, relate, organize and present knowledge on the subject in an argued response	50	B10 C2
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	B10 C2 D10
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	B10 C2 D10

Other comments on the Evaluation

1. Ordinary call (December-January)

1.1 Continuous assessment

- The final mark G0 results from the classroom mark A0 (80% of the final mark), on topics of Parts I and II, and the lab mark

L0 (20% of the final mark), on topics of Part III.

- Mark A0 combines the classroom mark C0 (40% of the final mark), that is obtained from theoretical-practical tests (essay-questions and problem/exercise solving) to be developed during the term, and the classroom mark F0 (40% of the final mark), that is obtained from an end-of-term theoretical-practical test to be held on the same date that the exam of the ordinary call.

- Mark L0 combines the mark L01 (10% of the final mark), that is obtained from theoretical-practical tests to be developed during the term (essay-questions and problem/exercise solving) on topics of Part III.1, and the mark L02 (10% of the final mark) that is obtained from a lab report corresponding to topics of Part III.2. In addition, after each lab session of Part III.1 a lab report must be handed in. Only students that have regularly attended the lab sessions and delivered all the reports can obtain a mark L0 different form "0,0".

- The final mark of the continuous assessment in the ordinary call is obtained as

G0 = A0 (80%) + L0(20%) = C0 (40%) + F0 (40%) + L01 (10%) + L02 (10%)

1.2 Global assessment

- The final mark G1 results from the classroom mark A1 (80% of the final mark), on topics of Parts I and II, and the lab mark L1 (20% of the final mark), on topics of Part III.1.

- Mark A1 combines marks C1 (40%of the final mark) and F1 (40% of the final mark), that are obtained from theoretical-practical tests (essay-questions and problem/exercise solving).

- Mark L1 (20% of the final mark) is obtained from a theoretical-practical test (essay-questions and problem/exercise solving).

- The final mark of the global assessment in the ordinary call is obtained as

G1 = A1 (80%) + L1(20%)= C1 (40%) + F1 (40%) + L1 (20%)

2. Extraordinary call (June-July)

- All students, whether they have waived continuous assessment or not, will obtain 100% of their final mark G2 from an exam corresponding to the extraordinary call.

- The final mark G2 results from the classroom mark A2 (80% of the final mark), on topics of Parts I and II, and the lab mark L2 (20% of the final mark), on topics of Part III.1.

- Mark A2 combines marks C2 (40% of the final mark) and F2 (40% of the final mark), that are obtained from theoretical-practical tests (essay-questions and problem/exercise solving).

- Mark L2 (20% of the final mark) is obtained from a theoretical-practical test (essay-questions and problem/exercise solving).

- The final mark of the continuous or global assessment in the extraordinary call is obtained as

G2 = A2 (80%) + L2(20%)= C2 (40%) + F2 (40%) + L2 (20%)

3. Common features and interconnection among the assessment alternatives

- In the continuous and global assessment modalities for the ordinary and extraordinary calls that have been defined in the previous sections, we can classify marks that are equivalent to each other in three sets with three elements each: classroom marks C0, C1 and C2, classroom marks F0, F1 and F2 and lab marks L0, L1 and L2. If C is the most recent valid mark from C0, C1 and C2, F is the most recent valid mark from F0, F1 and F2 and L is the most recent valid mark from L0, L1 and L2, the final mark G in the ordinary or the extraordinary call, either for continuous or global assessment, is obtained as

G =C(40%) + F (40%) + L(20%)

- To pass the course, a student must obtain a final mark G equal to or higher than 5 in any of the assessment alternatives.

- To obtain the final mark G1 in the ordinary call the students, whether they have waived continuous assessment or not, can choose between:

a) answering the part of the exam of the ordinary call corresponding to marks C1, F1, and/or L1, that will be used in the formula of the final mark of the ordinary call G1.

b) use the most recent valid mark of each type (C0, F0 and/or L0) to be used instead of marks C1, F1 and/or L1, respectively,

in the formula of the final mark of the ordinary call G1, not taking the corresponding part of the exam of this call.

- To obtain the final mark G2 in the extraordinary call the students, whether they have waived continuous assessment or not, can choose between:

a) answering the part of the exam of the extraordinary call corresponding to marks C2, F2, and/or L2, that will be used in the formula of the final mark of the extraordinary call G2.

b) use the most recent valid mark of each type (C0 or C1, F0 or F1 and/or L0 or L1) to be used instead of marks C2, F2 and/or L2, respectively, in the formula of the final mark of the extraordinary call G2, not taking the corresponding part of the exam of this call.

4. End-of-degree call

- The end-of-degree call follows the same assessment scheme as the extraordinary call.

- The end-of-degree assessment is completely independent of the assessments in the ordinary and extraordinary calls (in particular, the features and interconnections described in the previous section do not apply).

5. Supplementary assessment rules

- Students who do not take any of the tests (C, F, L) on the day of the final test will receive a grade of "no presentado" for that call.

- Students should not have access to or use any electronic device during the tests and exams, unless specifically authorized. The mere act of taking an unauthorized electronic device into the examination room will result in the student failing the subject and the final mark in the corresponding call will be "suspenso (0,0)".

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

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

6. Ethical commitment

Every student is expected to behave in an appropriate ethical manner. Should unethical conduct be detected (copying, plagiarism, utilization of unauthorized electronic devices, or others), the student will be considered not to have fulfilled the necessary requirements to pass the subject. In this case, the final mark in the corresponding call 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	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	English			
Department				
Coordinator	Cabarcos Rey, Adrián			
Lecturers	Cabarcos Rey, Adrián Conde Fontenla, Marcos			
E-mail	acabarcos@uvigo.gal			
Web	http://moovi.uvigo.gal			
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			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C8	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.
C25	CE25 Applied knowledge of the basics of fluidmechanics systems and machines.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
Understand fundamentals of hydraulic machines	B3	C8 C25	D2 D9 D10
Acquire skills for sizing pumps facilities and fluid machines	B3	C8 C25	D2 D9 D10

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	31.5	60.5	92
Laboratory practical	6	10	16
Problem solving	12	27	39
Essay questions exam	1	0	1
Essay questions exam	0.75	0	0.75
Essay questions exam	0.75	0	0.75
Essay questions exam	0.5	0	0.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

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	Training and Learning Results		
Laboratory practical	Assessment may include: - Problem solving - Practical reports - Oral/written practical questions	10	B3	C8 C25	D9 D10
Essay questions exam	Final written exam on the official date indicated by the school that may consist of: - Theoretical/practical questions - Exercise/problem solving - Topic to be developed Minimum required grade: 4 out of 10.	40	B3	C8	D2 D9 D10
(*)	N/A				
Essay questions exam	Partial written test that may consist of: Theoretical/practical questions Exercise/problem solving Topic to be developed	20	B3	C8 C25	D2 D9 D10
Essay questions exam	Partial written test that may consist of: Theoretical/practical questions Exercise/problem solving Topic to be developed	20	B3	C8 C25	D2 D9 D10
Essay questions exam	Partial written test that may consist of: Theoretical/practical questions Exercise/problem solving Topic to be developed	10	B3	C8 C25	D2 D9 D10

Other comments on the Evaluation

Global Evaluation:

In the two official editions, renouncement of continuous assessment will be carried out following the procedure and deadline established by the institution. The global evaluation methodology will consist of a single written exam on the official date set by the school, which will account for 100% of the grade, and all theoretical and practical contents of the subject will be evaluated.

Continuous Assessment: *Ordinary Call /First attempt*.

It will consist of different tests conducted throughout the course and a final exam on the official date previously set by the institution. In this final exam, a minimum grade of 4 out of 10 will be required to pass the subject. To pass, the final grade must be at least 5 out of 10. If the minimum grade is not achieved in the final exam, the student will be awarded a maximum grade of 4.5.

Continuous Assessment: *Extraordinary Call / Second attempt*.

The student's grade will be calculated under two assumptions: considering continuous assessment (continuous assessment items = 60%, final exam = 40%, and a minimum score of 4 out of 10) and considering global assessment (final exam = 100%). The higher of the two records will be awarded. The test will be conducted on the official date previously set by the center. If the minimum grade is not achieved in the final exam, the student will be awarded a maximum grade of 4.5.

Ethical Behavior: It is expected that the student demonstrates appropriate ethical behavior, paying particular attention to what is indicated in Articles 39, 40, 41, and 42 of the Regulations on evaluation, grading, and quality of teaching and the student learning process at the University of Vigo (approved on April 18, 2023).

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	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language				
Department	Matemática aplicada I			
Coordinator	Vidal Vázquez, Ricardo			
Lecturers	Meniño Cotón, Carlos Vidal Vázquez, Ricardo			
E-mail	rvidal@uvigo.es			
Web				
General description				

Resultados de Formación e Aprendizaxe
Code

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

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 ortonormaies completos 3. Series de Fourier trigonométricas 4. Problemas de SturmLiouville 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	Training and Learning Results
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.	40	
Resolución de problemas e/ou exercicios	Avaliación continua: Asistencia as clases teóricas e practicas(10%). Presentación dunha worksheet en Sage cos traballos propostos ó alumno: Traballo 1º (metade de curso): 20% Traballo 1º (final de curso): 30%	60	

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	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	González Baldonedo, Jacobo			
Lecturers	González Baldonedo, Jacobo Segade Robleda, Abraham			
E-mail	jacobo.gonzalez.baldonedo@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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
C13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
C26	CE26 Knowledge and abilities to calculate, design and test machines.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D16	CT16 Critical thinking.
D20	CT20 Ability to communicate with people not expert in the field.

Expected results from this subject	Training and Learning Results		
Knowledge of calculation methods applied in Mechanical design.	B3 B4 B5	C13 C26	D2 D9 D16
Knowledge and design capabilities applied in mechanical power transmissions.	B6	C13 C26	D2 D9 D16 D20
Knowledge of the fundamental laws applied in the study of machine elements.	B11	C13 C26	D2 D9 D16 D20
Calculation capabilities and analysis applied for different machine components.	B3 B11	C13 C26	D2 D9 D16

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	45	63
Problem and/or exercise solving	2.5	0	2.5
Problem and/or exercise solving	0	3	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	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	Training and Learning Results		
Laboratory practical	The attendance and participation of students in laboratory practices will be valued. To complete the practice activities, a online questionnaire will need to be solved, covering aspects derived from the material taught in the practice.	30		C13 C26	D2 D9 D16 D20
Problem and/or exercise solving	Several problem-solving tests will be formulated in Moovi, which will be solved virtually. The scheduling of these tests will be done with sufficient advance notice and in accordance with the current regulations.	30	B3 B4 B5 B6 B11	C13 C26	D2 D9 D16
Problem and/or exercise solving	Students will be evaluated in a final written exam on the date established in the exam calendar. This test will assess all the content developed in the subject.	40	B3 B4 B5 B6 B11	C13 C26	D2 D9 D16 D20

Other comments on the Evaluation

Continuous Assessment

1st Edition

The subject will be approved if a final grade of 5 or higher is obtained as follows:

- Attendance and successful completion of laboratory/computer room/equivalent classroom will have a maximum rating of 3 points towards the final grade. To add the practice grade, a minimum attendance of 7 sessions is required, and a minimum rating of 1 point out of 3 for the practice activities.

- The problem-solving tests in Moovi will have a maximum rating of 3 points towards the final grade. To have this section count, a minimum of 1 point out of 3 is required.
- The final exam will have a maximum rating of 4 points towards the final grade. A minimum of 1.5 out of 4 is established for this part of the evaluation system. If the minimum is not obtained in the final exam, the final grade will be the rating of this test weighted out of 10.

There may be voluntary work that allows students to increase their marks in addition to those indicated in the previous sections.

2nd Edition

In the second edition, the problem-solving tests can be retaken, so the final test will have a maximum rating of 7 points with a minimum score of 2.5 (out of 7). The grade for those who do not reach the minimum in this part will be the rating of the problem-solving test weighted out of 10 points.

Overall Evaluation

For those who opt for the global evaluation system following the mechanisms established by the School of Industrial Engineering, the evaluation system will consist of the following sections:

- Evaluation of the practical part: This test consists of solving a series of questions related to the content taught in the practical sessions of the subject. It will have a maximum rating of 3, and a minimum of 1 point must be obtained for it to count.
- Problem-solving and/or exercises test: The final exam will have a maximum rating of 7 points towards the final grade. A minimum of 2.5 out of 7 is established for this part of the evaluation system. If the minimum is not obtained in the final exam, the final grade will be the rating of this test weighted out of 10.

Ethical Commitment

It is expected that the student presents appropriate ethical behavior. In the event of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, among others), it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade for the current academic year will be a fail (0.0).

The use of any electronic devices during assessment tests will not be allowed unless expressly authorized. The introduction of an unauthorized electronic device in the exam room will be considered grounds for not passing the subject in the current academic year, and the overall grade will be a fail (0.0).

*A numerical grading system from 0 to 10 points will be used according to the current legislation (RD 1125/2003 of September 5, BOE of September 18).

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	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Riveiro Rodríguez, Antonio			
Lecturers	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.			

Training and Learning Results

Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C14	CE14 Knowledge and use of the principles of strength of materials.
D2	CT2 Problem solving.
D5	CT5 Information Management.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
Knowledge of the foundations of the elasticity theory	B3	C14	
Further deepening on mechanics of materials and stress analysis	B3 B4	C14	D2 D10
Knowledge of deformations in beams and shafts	B3 B4	C14	D2 D9
Ability to apply the knowledge of elasticity and mechanics of materials, and to analyze the mechanical performance of machines, structures, and general structural elements	B4	C14	D2 D5 D9
Ability to take decisions about suitable material, shape and dimensions for a structural element subjected to a specific load	B4	C14	D2 D5 D9 D17
Knowledge of different solving methods for structural problems and ability to choose the most suitable method for each specific problem	B4	C14	D2 D5 D9

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	7	25
Autonomous problem solving	0	15	15
Problem and/or exercise solving	2	17.5	19.5
Self-assessment	0	5	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	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	Training and Learning Results
Laboratory practical	Active participation in all classes will be valued, and when applicable, the submission of the lab reports and their content will be assessed according to the guidelines provided by the lecturers. The grading will be on a scale of 0 to 10. It will be added to the average obtained in the problem-solving tests, only in the event that it reaches the minimum required	5	B4 C14 D2 D5 D9 D10 D17
Problem and/or exercise solving	Several tests will be proposed to assess the acquired learning results in the subject. They will consist of problem-solving and/or theoretical questions by the students. None of these tests will exceed 40% of the overall grade for the subject. The tests will be conducted throughout the course during class hours and/or on dates/times approved by the institution. The final test will be performed during the official examination schedule approved by the Comisión Permanente of the School of Industrial Engineering. It will be graded on a scale of 0 to 10. The minimum average grade for all tests will be 4.5/10. In the second opportunity of the course's examination session, there will be a single test that encompasses all the content of the subject, carrying a weight of 100% of the final grade. In this case, the minimum mark to pass the subject will be 5/10. The duration of the test, as well as the weight of each question, will be provided at the time of the test.	95	B3 C14 D2 B4 D9

Other comments on the Evaluation

It will be necessary to obtain a minimum score of 5 out of 10 to pass the subject. Students who have been granted with the waive of continuous assessment may take the final exam, which will be the 100% of the final mark. This exam will assess the competencies covered in the entire subject.

Comments regarding continuous assessment activities:

The failure to submit lab reports, whether justified or not, will not result in the repetition of the lab practice on a different date.

The dates and locations for all exam sessions will be set by the School of Industrial Engineering before the start of the course and will be made public. This information can be consulted on: https://eei.uvigo.es/gl/alumnado/planificacion-academica/

Ethical commitment: it is expected an adequate ethical behavior of the student. If any unethical behavior is detected (cheating, plagiarism, unauthorized use of electronic devices, etc.), it will be considered that the student does not meet the necessary requirements to pass the course. In such cases, 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

José Antonio González Taboada, **Tensiones y deformaciones en materiales elásticos**, 1st ed., Tórculo, 1997

José Antonio González Taboada, **Fundamentos y problemas de tensiones y deformaciones en materiales elásticos**, 1st ed., Tórculo, 2008

Manuel Vázquez, **Resistencia de Materiales**, 4th ed., Ed. Noela, 2008

Complementary Bibliography

Luis Ortiz Berrocal, **Elasticidad**, 3rd ed., McGraw-Hill, 1998

Robert Mott, Joseph A. Untener, **Applied Strength of Materials**, 6th ed., CRC Press, 2016

Ansel C. Ugural, Saul K. Fenster, **Advanced Mechanics of Materials and Applied Elasticity**, 6th ed., Pearson, 2021

Arthur P. Boresi, **Advanced mechanics of materials**, 6th ed., John Wiley & Sons, 2003

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				
Enxeñaría de fabricación				
Subject	Enxeñaría de fabricación			
Code	V12G363V01604			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	2c
Teaching language	Castelán Galego			
Department	Deseño na enxeñaría			
Coordinator	Carou Porto, Diego			
Lecturers	Carou Porto, Diego			
E-mail	diecapor@uvigo.es			
Web	http://campusremotouvigo.gal/			
General description	Esta materia afonda nos fundamentos dos procesos de fabricación (deseño, tecnoloxías, planificación, simulación e control de calidade).			

Resultados de Formación e Aprendizaxe	
Code	
B3	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.
C20	CE20 Coñecemento aplicado de sistemas e procesos de fabricación, metroloxía e control de calidade.
D2	CT2 Resolución de problemas.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.
D20	CT20 Capacidade para comunicarse con persoas non expertas na materia.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
□ Conocer a base tecnolóxica e aspectos básicos dos procesos de fabricación	B3	C20	D2
□ Comprender os aspectos básicos dos sistemas de fabricación			D8
□ Adquirir habilidades para la selección de procesos de fabricación e elaboración da planificación de fabricación			D9 D10
□ Desenvolver habilidades para a fabricación de conxuntos e elementos en entornos CADCAM			D17
□ Aplicación de tecnoloxías CAQ			D20

Contidos	
Topic	
BLOQUE I	Tema 01 - Introducción a os Sistemas e Tecnoloxías de Fabricación Tema 02 - Enxeñaría Concurrente e DFMA Tema 03 - Control de Procesos. Indicadores de rendemento Tema 04 - Costes na Fabricación Tema 05 - Automatización e Industria 4.0 Tema 06 - Fabricación Aditiva Tema 07 - Conformado por Moldeo Tema 08 - Conformado por Deformación Plástica Tema 09 - Conformado por Arranque de Viruta Tema 10 - Conformado de Composites Tema 11 - Metroloxía. Especificacións e Industrialización de Produtos
BLOQUE II	Deseño e Fabricación a través de entornos CAM

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	13	26	39
Resolución de problemas	19.5	39.5	59
Prácticas con apoio das TIC	18	0	18
Resolución de problemas e/ou exercicios	0	10	10
Exame de preguntas obxectivas	0	3	3

Práctica de laboratorio	0	21	21

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

Metodoloxía docente

	Description
Lección maxistral	As clases teóricas realizaranse combinando as explicacións de lousa co emprego de presentacións de computador e vídeos.
Resolución de problemas	Presentación e resolución por parte do profesor de problemas relativos aos procesos de fabricación estudados de maneira teórica coa participación activa das/os estudantes.
Prácticas con apoio das TIC	Introdución ao emprego de software de simulación de procesos de fabricación por parte do profesor. Coas instrucións recibidas e traballo autónomo, as/os estudantes poderán resolver problemas específicos que permitan mellorar o seu coñecemento sobre os procesos estudados.

Atención personalizada

Methodologies	Description
Lección maxistral	Tanto na clase como nas horas de titoría que o profesor comunicará aos estudantes ao comezo do curso
Prácticas con apoio das TIC	Tanto na clase como nas horas de titoría que o profesor comunicará aos estudantes ao comezo do curso
Resolución de problemas	Tanto na clase como nas horas de titoría que o profesor comunicará aos estudantes ao comezo do curso

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas e/ou exercicios	Problemas a realizar nos exames da materia	40	B3	C20	
Exame de preguntas obxectivas	Preguntas obxectivas a realizar nos exames da materia	40	B3		D2 D8 D9 D10
Práctica de laboratorio	Entrega de traballos de prácticas	20	B3	C20	D2 D8 D9 D10 D17 D20

Other comments on the Evaluation

PRIMEIRA OPORTUNIDADE:

a) Modalidade de Avaliación continua

A avaliación continua realizarase durante o período de impartición da materia. Nesta modalidade, todas as probas son obrigatorias. A contribución de cada proba á nota total é como segue:

- Unha proba de avaliación durante o curso (40% da cualificación final total).
- Elaboración e presentación dos traballos de prácticas (20% da cualificación final total).
- Exame Final da materia (40% da cualificación final total), na data marcada polo centro.

A proba de avaliación realizada durante o curso e o exame final incluirán: preguntas obxectivas e problemas, sendo a ponderación de cada parte o 50% do total das mesmas.

b) Modalidade de Avaliación global.

A renuncia á avaliación continua farase segundo os procedementos e prazos que defina o centro.

Aqueles estudantes que renuncien á metodoloxía de avaliación continua terán que realizar un exame escrito en data oficial coas mesmas tres partes e porcentaxes da avaliación continua.

Para superar a materia na Primeira Oportunidade en calquera das dúas modalidades, deberase alcanzar un 40% como mínimo en cada un do tres apartados e alcanzar unha nota total igual ou superior a 5 (escala 0 a 10). De non cumprirse este

requisito, a nota que figurará na acta non poderá ser nunca superior a un "4,9" (escala 0 a 10)

SEGUNDA OPORTUNIDADE:

a) Modalidade de Avaliación continua

Aqueles estudantes que na Primeira Oportunidade avaliáronse pola modalidade de Avaliación continua, si deséxano, poderán manter as cualificacións dos tres apartados a condición de que sexan aprobadas (nota igual ou maior a 5 en escala 0 a 10) na Primeira Oportunidade. En caso contrario deberán acollerse á modalidade de "Avaliación Global"

b) Modalidade de Avaliación global:

Mantéñense os criterios establecidos na Primeira Oportunidade.

Para superar a materia na Segunda Oportunidade en calquera das dúas modalidades, deberase alcanzar un 40% como mínimo en cada un do tres apartados e alcanzar unha nota total igual ou superior a 5 (escala 0 a 10). De non cumprirse este requisito, a nota que figurará na acta non poderá ser nunca superior a un "4,9" (escala 0 a 10)

Compromiso Ético: Esperar que o alumno/a presente un comportamento ético adecuado, tal como recóllese nos Artigos 39, 40, 41 e 42 do Regulamento sobre a avaliación, a cualificación e a calidade da docencia e do proceso de aprendizaxe do estudiantado, aprobado no Claustro do 18 de Abril de 2023. No caso de detectar un comportamento non ético (copia, plaxio, uso de aparellos eléctricos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso, a cualificación global no presente curso académico será de suspenso (0.0).

AVISO: No suposto de haber discrepancias entre as diferentes versións lingüísticas da guía, prevalecerá o recolleito na versión de castelán.

Bibliografía. Fontes de información

Basic Bibliography

Serope Kalpakjian, Steven R. Schmid, **Manufacturing engineering and technology**, 7ª, Pearson Education,, 2014

Rovira, Norbert, **Fusion 360 con ejemplos y ejercicios prácticos**, 1ª, Marcombo, 2020

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

Complementary Bibliography

Mikell P. Groover, **Principles of Modern Manufacturing**, 5ª, Wiley, 2013

J.T. Black, Ronald A. Kohser, **Degarmo's materials and processes in manufacturing**, 12th ed, Wiley, 2017

AENOR, **AENORmas (Norweb)**, AENOR, 2021

Campbell, John, **Complete Casting Handbook**, 2, Elsevier, 2015

Rubio Alvir, Eva, **Ejercicios y problemas de mecanizado**, 1ª, Pearson Educación, 2011

Gaurav Verma, **Autodesk Fusion 360 Black Book**, CADCAMCAE Works, 2024

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

Recomendacións

Subjects that are recommended to be taken simultaneously

Control e automatización industrial/V12G340V01702
Xestión da calidade, a seguridade e a sostibilidade/V12G340V01602
Enxeñaría de materiais/V12G340V01803
Organización da produción/V12G340V01601

Subjects that it is recommended to have taken before

Ciencia e tecnoloxía dos materiais/V12G340V01301
Fundamentos de sistemas e tecnoloxías de fabricación/V12G340V01305

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				
Electrical machines				
Subject	Electrical machines			
Code	V12G363V01605			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	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				

Training and Learning Results
Code

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

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	29.5	65	94.5
Objective questions exam	1	0	1
Problem and/or exercise solving	1.5	0	1.5
Laboratory practice	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
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	Training and Learning Results
Problem solving	The assessment method will be a numerical resolution of some exercises of electrical machines A minimum mark of 30% will be required in this part	40	
Laboratory practical	the student should complete properly the practices proposed along the course to get the maximum 20% of the mark. The professor will decide the final mark depending of the laboratory results of every student	20	
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 30% 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.	40	

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	Choose	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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
B4	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.
C4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
D2	CT2 Problem solving.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
To know the bases of chemical technology.	B3	C4	D9
To apply mass and energy balances to real systems.	B4	C4	D2 D9 D10 D17
To know and understand the basic aspects of mass transfer.	B3	C4	D9
To know the fundamentals of separation processes and their application to real cases.	B4	C4	D2 D9 D10 D17

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	16	46	62
Problem solving	16	31	47
Laboratory practical	4	4	8
Studies excursion	6	1	7
Simulation	4	2	6
Problem and/or exercise solving	3	9	12
Report of practices, practicum and external practices	0	2	2
Objective questions exam	1.5	4.5	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	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. Besides along the course made diverse controls in which the students will have to resolve problems of the level of similar difficulty to the made in class.
Laboratory practical	The students will perform some experiments in the laboratory related to the topics covered throughout the course. The aim of the laboratory practices is to deepen basic concepts.
Studies excursion	Visits of the students to companies of the surroundings to make an approach to the business reality and visualise the application of the theoretical contents given in the subject.
Simulation	Learning and utilisation of programs of simulation applied to the contents of the subject.

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.
Studies excursion	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.
Simulation	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	Training and Learning Results		
Studies excursion	Questions and activities related to the visit to be made will be carried out. These may take place before or after the visit.	5	B4	C4	D2 D9 D10 D17
Simulation	Realisation of diverse simulations of chemical processes that will have to deliver after the sessions of simulation that will make along the course	5	B3 B4	C4	D2 D9 D10 D17
Problem and/or exercise solving	They students will perform diverse controls along the academic term, consisting in the resolution of problems related to the subject contencts and developed in time/conditions established by the lecturer. Each of these activities will not surpass 40% of the final qualification of the subject.	60	B3 B4	C4	D2 D9
Report of practices, practicum and external practices	It will be evaluated in this item both the realisation of the practices of laboratory like the reasoning and treatment of the results obtained in the development of the practical classes of laboratory.	5		C4	D9 D10 D17

Objective questions exam	This evaluation test includes two types of exams with objective questions: + multiple-choice questions in the lecture sessions, which will represent 5% of the total. + Short questions or multiple-choice questions that will be asked in different controls throughout the course, which will represent 20% of the total value of the exam.	25	B3 B4	C4	D2 D9 D10 D17

Other comments on the Evaluation

CONTINUOUS ASSESSMENT:

The participation of the student in any of the evaluation systems of the subject(laboratory practicals, problem solving and exercises, simulation, field trip, exam of objective questions) will imply the condition of being evaluated and its qualification in the records. A minimum attendance of 75% of the practicals, field trips and simulations of the course is required to have the right to the evaluation of the same. Otherwise, the mark for these evaluation systems will be 0.0.

A student who is not under "Global assessment" will fail if he/she does not achieve a MINIMUM mark of 4.0 points (out of 10) in each of the aforementioned tests. However, they will have the opportunity to recover the non-passed parts in the May examination.The student will pass the subject if the FINAL GRADE is ≥5.0, that is, if the sum of the grades obtained in the different evaluation systems of the subject is ≥ 5.0.

Second call: In the second round, students will take a final exam in which they will be assessed on all the teaching methodologies applied
throughout the course. This mark will be 100% of the grade.

GLOBAL ASSESSMENT: When a student requests the global evaluation, a "FINAL EXAMINATION" will be held on the dates established in the school calendar. The grade will be the sum of 90% of the mark obtained in the "FINAL EXAMINATION" 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	Choose	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.			

Training and Learning Results
Code

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

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. 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 2: Introduction to the control of processes based in the System On Chip (SOC) ESP32.	Introduction to the control of processes based in uControladores. Study of the ESP32. Introduction to the surroundings of development of the platform M5Stack. Implementation of an application of control based in the M5Stack Stick C

Laboratory practice 3: 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.
Metored work.	- Implementation of a circuit of the measure and the control of a physical variable and his back acquisition by means of distinct hardware of capture. - Incorporate the information captures in a system of business management, to make tasks of control of production and control of processes.

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	Training and Learning Results
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.	30	
Objective questions exam	In the dates indicated by school and through continuous evaluation, will make the evaluation of short questions of test.	30	

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	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Alonso Rodríguez, José Antonio			
Lecturers	Alonso Rodríguez, José Antonio Díaz Vilariño, Lucía Seoane González, Pablo			
E-mail	jaalonso@uvigo.es			
Web	http://webs.uvigo.es/oficinatecnica			
General description	This matter has like vision and like mission approach to the students to his back professional life through the knowledge, handle and application of methodologies, technical and tools oriented to the preparation, organisation and management of projects and other technical documents. It employed a practical approach of the subjects, looking for the integration of the knowledges purchased to the long of the career of face to his application to the development of the methodology, organisation and management of technical works, as true essence of the profession of engineer in the frame of his attributions and fields of activity. It will promote the development of the competitions of the matter by means of a theoretical approximation-practical, in which the exposed contents of theoretical way develop by means of the realisation of practical activities and works of application oriented to the industrial reality of the profession, assimilating the agile and precise employment of the distinct rule of application and of the best practices established. Given the variety that produces in the spectrum of professional exits, the academic program possesses a part of general contents to all the Industrial Engineers, in which it treats to transmit those appearances that reinforce the *pluridisciplinaridad and possesses another more specific part of the speciality, that does reference to methodological or normative appearances of this field. Likewise the strategy employed allows to expose to the students the professional alternatives that open him , from the free professional exercise (**peritaciones, *dictámenes, reports, projects, etc.), even his immersion in a small / average technical office more oriented the installations or even to the design of product.			

Training and Learning Results	
Code	
B1	CG1 Ability to design, develop, implement, manage and improve products and processes in various industrial fields, through analytical, computational and experimental appropriate techniques.
B2	CG2 Ability to lead activities related to CG1 competence.
C18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D7	CT7 Ability to organize and plan.
D8	CT8 Decision making.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D15	CT15 Objectification, identification and organization.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

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

Skills for using information and communication systems in the industrial field.		C18	D3 D5 D6 D9 D10 D17
Handling design methods, techniques and tools, and project organisation and management.	B1 B2	C18	D1 D2 D5 D6 D7 D8 D10 D15 D17 D20
Skills for the elaboration of project documents and other similar technical documents.	B1 B2		D1 D3 D5 D6 D7 D9 D14 D15 D17
Skills for the tecnical management and supervision of projects in the Industrial Engineering field.	B2	C18	D1 D2 D3 D5 D6 D7 D8 D9 D14 D16 D17 D20
Skills for appropriatelly communicating documents, procedures, and results in the Industrial Engineering field.			D3 D5 D6 D7 D14 D17 D20

Contents

Topic	
Presentation	Presentation Guides Educational Methodology of work. Groups of work Sources of information and communication: SUBJECT and other Knowledges and computer applications for the matter.
Technical office.	Introduction. Functions. Organisation of the work. Technicians of Work in team. Integration with the systems of the company. *Kanban. Taking of decision by means of weighting of criteria. Communication.
Industrial project.	Project: Concept, classification, structure, cycle of life. Documents of the project: Index, memory, planes, *pliegos of conditions, budget, studies with own entity. Normalisation. It JOINS 157002. Memory of the project: Structure and content

Industrial project. Planes	Structure and index of the planes. Typology of representation: dimension and relation. Block of titles. Sizes and scales. Folded. Criteria for the preparation of planes. Example; planes of distribution. Example: planes of installations. Diagrams of principle. Legend of symbology.
Legislation.	Legislation Interpretation of technical legislation Generic technical legislation applied to the speciality: Municipal, occupational risk prevention and Technical Building Code.
Fires protection	Basic concepts: fire, typology, fire prevention elements. Application of fire prevention regulations: classification, sectorisation, classification of materials, NRI, evacuation, means of protection.
Basic concepts of construction	Basic elements of construction. Cover. *Cimentación. Structural elements. Coatings. Carpentries. Finishings. Examples.
Methodology of design of installations	Types of installations. Determination of loads. Elements of feeding of the loads. Elements of performance control and security. Planes of installations and diagrams of principle.
Budget and planning.	Measurement and economic appraisal Theory of project management and planning. Methodology of planning: Project decomposition structure, databases, planning development.
Fold of Conditions.	Types. Administrative Technical Facultativas Bidding and contracting of projects.
Studies with own entity.	Relative studies to the fulfillment of the legislation of labour risks: Basic Study of Security and Health. Relative studies to the fulfillment of the legislation of management of waste.
Other technical documents.	Report: Concept, classification, structure. Certifications . Homologation *Peritaciones, Valuations.
Professional activity.	Processing: visa, notary, Public Organisms, etc. Management of licences, permissions and permissions in front of public and personal institutions. Bidding and contracting of projects.
Patent rights.	Technological innovation and patent rights. Patents and models of utility.
Communication	Technicians of presentation of oral works and written

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Lecturing	12	12	24
Mentored work	2	6	8
Project based learning	12	35	47
Problem solving	6	6	12
Practices through ICT	6	4	10
Design Thinking	4	20	24
Scientific events	1	4	5
Presentation	1	4	5
Presentation	1	3	4
Essay questions exam	1	3	4
Project	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
Introductory activities	It presented the matter, information of the contents of the same, methodologies that go to apply, works to make in the subject and form of evaluation. Likewise they made dynamic in the class to boost the interrelationship in the students.
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.
Mentored work	Elaborate a relative technical report the any question related with the Industrial Engineering, with the quality and the rigour that expects of an Industrial Engineer.

Project based learning	It will make a work applying the methodology of "Learning Based in Projects- **ABP". Realisation of a project of engineering, working with an open team. It will do upsetting in the application of tools and knowledges of industrial engineering to create solutions of engineering for the real needs of an industry. They make reflections of ethical and social character on different appearances of the works made (consequences of the industrial fires, labour security, management of waste, among others) These appearances collect in the *rubrica of evaluation.
Problem solving	The student has to develop the ideal or correct solutions the the exercises posed that they base in the theory given. They made applying formulas, algorithms or procedures of transformation gives available information. It will be necessary the interpretation of the results.
Practices through ICT	Activities of application of the knowledges in a determinate context, and of acquisition of basic skills and *procedimentales in relation with the matter, through the TIC.
Design Thinking	It created a group *interdisciplinar with students of other subjects and degrees. This group, applying the methodology "*Design *Thinking" aroused a work of implantation and/or improvement on a concrete activity.
Scientific events	To present the ideas developed by the students in the groups *colaborativos organises a presentation in format congress. This will be public and with diffusion in different media.
Presentation	Like alternative to the application of the "*Design *Thinking and the scientific events", the *profesorado, will be able to propose the presentation of the project made in "the learning based in projects".

Personalized assistance

Methodologies	Description
Project based learning	The student made a project of engineering, working with an open team. It will do upsetting in the application of tools and knowledges of industrial engineering to create solutions of engineering for the real needs of an industry. They will do *tutorías of group with the professor to clear doubts and for the follow-up of the work.
Mentored work	The student, of individual way, elaborates a technical report, or similar document, on a subject proposed by the professor. The *tutorías will be individual. They cleared the doubts of the student and helped him in the organisation and planning of the work. Can make *tutorías in small group, gathering to students with the even problem, for a better efficiency.
Design Thinking	The students, in multidisciplinary group with students of other degrees, made a consistent work in posing a solution to a problem posed. It will do applying the methodology *Design *Thinking and applying, simultaneously, the methodology Learning like Service. They are scheduled meetings for explanation of the methodologies to apply and *tutorías of group for the follow-up of the works.
Scientific events	It will work with the different groups of students to help them to prepare the public exhibition of his work. It made several essays with them and oriented them to achieve an effective presentation.

Assessment

	Description	Qualification	Training and Learning Results		
Lecturing	Theory: The proofs will be of type test or of brief answer. Minimum note of this part: 5 on a qualification of 10 (in this part)	15-35	B1 B2		D2 D9
Mentored work	Elaborate a relative technical report the any question related with the Industrial Engineering, with the quality and the rigour that expects of an Industrial Engineer. It published a *rúbrica of evaluation in the platform *MOOVI of the subject.	15	B1		D1 D3 D5 D6 D7 D8 D9 D10 D15 D16
Project based learning	Realisation of a project of engineering, working with an open team. It will do upsetting in the application of tools and knowledges of industrial engineering to create solutions of engineering for the real needs of an industry. It published a *rúbrica of evaluation in the platform *MOOVI of the subject. The evaluation includes an individual proof on the work and *ponderara the note of the project as it will expose in the *rubrica of evaluation.	35-40	B1 B2	C18	D2 D3 D5 D7 D8 D9 D10 D14 D17 D20

Scientific events	Presentation of the ideas developed by the students in the groups *colaborativos. This activity will be public and with diffusion in different media. It published a *rúbrica of evaluation in the platform *MOOVI of the subject.	0-25	D1 D3 D5 D6 D17 D20
Presentation	Presentation of group of class of the work made, well with the methodology of "*Design *Thiking", well the project developed in the methodology of "learning based in projects". The criterion establishes it the *profesorado of the group.	5-15	D2 D5 D6 D7 D17 D20

Other comments on the Evaluation

EVALUATION SYSTEM:

The default evaluation system is the continuous evaluation system. Students who wish to use the non-continuous assessment system (global assessment) must officially request it, within the period and in the manner established by the management of the E.E.I. If the student does not request this waiver or does not obtain the favourable verdict of the waiver of continuous assessment, it is understood that he/she is in the continuous assessment system.

The evaluation will be carried out according to the criteria indicated by the teacher of the subject in the first class and which will be published on the MOOVI platform of the subject.

Attendance (and participation) in at least 80% of the practical classes is MANDATORY. CRITERIA FOR PASSING THE SUBJECT THROUGH CONTINUOUS ASSESSMENT:

In order to assess the subject through continuous assessment, a series of evaluable activities will be established in the first class of the course. Failure to pass any of these activities with a minimum mark of 5 means a failure and the need to take a global evaluation exam of the subject.

In order to pass the course through continuous assessment, two conditions must be met simultaneously:

a) obtain a minimum score of 5 out of 10 in each of the evaluable sections or parts indicated in the rubrics published.
b) obtain an average mark, weighted according to the percentages indicated above, of at least 5 out of 10.

The percentage that each of the sections represents in the grade for the subject is indicated in the following table:

Activity project 35%-40%
Technical report 15%
Theoretical tests: 15%-35%
Communication skills: 20%-30%

According to the characteristics of the group and at the teacher's discretion, 2 possible ways of assessing communication skills are established:

A) Presentation of the project carried out during the course, which may include: Summary of the work, type A- of the TFG, Summary of the project of between 250 and 300 words, visual support for the presentation (slides, models, etc.) and oral presentation.

B) Carrying out a collaborative work, with other degrees, and presentation of the same, which may include: Executive report of the work carried out using Design Thinking methodology, congress-type summary of between 250 and 300 words, visual support for the presentation (slides, models, etc.) and oral presentation. In this case **(option B)** the following events are established, **MANDATORY**, on the following dates (in the morning): **1st term groups:**

Initial meeting on **Friday 12 September** (Campus auditorium) Congress: **Friday 28 November** (Campus auditorium) 2nd term groups:

Initial meeting on **Friday 30 January** Congress: **27 March** CRITERIA FOR PASSING THE COURSE THROUGH GLOBAL ASSESSMENT: Students who choose to apply for global assessment will take an exam equivalent to the contents and competences of with the following structure:

1. Theoretical contents. 40% 2. Practical contents: 40%. 3. Communication skills and communication of results 20% ETHICAL COMMITMENT:

Students are expected to show appropriate ethical behaviour. By taking the course, students acquire a commitment to teamwork, collaboration and respect for classmates and teachers. In the case of detecting unethical behaviour (copying, plagiarism, use of unauthorised electronic devices and others) it will be considered that the student does not meet the necessary requirements to pass the course.

Sources of information
Basic Bibliography
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Tompkins, James A. White John A. Bozer, Yavuz A. Tanchoco J. M. A., **Planeación de instalaciones**, Cengage Learning editores S.A., 2011

Recommendations
Subjects that continue the syllabus
Final Year Dissertation/V12G360V01991

Subjects that it is recommended to have taken before
Graphic expression: Fundamentals of engineering graphics/V12G360V01101
Computer science: Computing for engineering/V12G360V01203

Other comments

They require basic knowledges of computing, of systems of representation, normalisation of Drawing, industrial normalisation and of construction.
For the acquisition of the planned competitions in this matter recommends the assistance and active participation in all the activities programmed and the use of the *tutorías, especially those referents to the review of the works.
The key point to surpass the subject successfully, is "to comprise" the matter and no so much his "memorisation". In case of doubts or questions, the student has to ask to the professor well in class, in the schedule of attention to the student or *telemáticamente.
Like general rule a doubt resolved avoids five *interrogantes in the future.
It recommends to the students the assistance to the *tutorías for the exhibition of doubts.
It recommends the active participation in the mechanisms of *tutorización.
Finally, and regarding the assistance, although they fix some minima in theory and practical, recommends to the students the assistance to the whole of the theoretical and practical days of the subject.

Didactic materials
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requires access to Internet and the tools *ofimáticas usual.
The documentation will be facilitated through the platform *MooVi and will be expanded and commented in the face-to-face

classes and rest of face-to-face activities.

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G363V01703			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly English			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella Cameselle Fernández, Claudio			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Subject that belongs to the Block of Common Subjects of the Industrial Technologies. It is part of the curricula of all Degrees of Industrial Engineering. 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. Subject of the "English Friendly" program. International students may request the teacher Claudio Cameselle Fernandez: a) Materials and bibliographic references for the follow-up of the subject in English. b) Attend tutorials in English. c) Tests and evaluations in English.			

Training and Learning Results	
Code	
B7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
C16	CE16 Basic knowledge and application of environmental technologies and sustainability.
D1	CT1 Analysis and synthesis.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D12	CT12 Research skills.
D17	CT17 Working as a team.
D19	CT19 Personal relationships.

Expected results from this subject	Training and Learning Results	
Basic knowledge and application of environmental technologies and sustainability	C16	D2 D3 D10 D19
Problem solving	C16	D2 D3 D10 D19
Oral and writing communication	C16	D2 D3 D10

Knowledge application to practical and real cases	C16	D2 D3 D10 D19
Analysis and synthesis	C16	D1 D2 D3 D9 D10 D12 D17 D19
Ability to analyze and determine the social and environmental impact of the technical solutions to environmental problems	B7	D1 D3 D9 D10 D17 D19

Contents	
Topic	
Lesson 1: Introduction to the environmental technology.	1. Material cycle economy. 2. Introduction to the best available techniques (BAT).
Lesson 2: Management of waste and effluents.	1. Urban waste management. 2. Industrial waste management. Industrial waste treatment facilities. 3. Regulations.
Lesson 3: Treatment of urban and industrial wastes.	1. Valorization. 2. Physico-chemical treatment. 3. Biological treatment. 4. Thermal treatment. 5. Landfilling.
Lesson 4: Treatment of industrial and municipal wastewaters.	1. Characteristics of municipal and industrial wastewaters. 2. Wastewater treatment plant. 3. Sludge treatment. 4. Water treatment and reuse 5. Regulations
Lesson 5: Atmospheric pollution.	1. Types and origin of atmospheric pollutants. 2. Dispersion of pollutants in the atmosphere. 3. Effects of the atmospheric pollution. 4. Treatment of polluting gas emissions. 5. Regulations
Lesson 6: Sustainability and environmental impact assessment	1. Sustainable development 2. Life cycle analysis and economy. 3. Ecological footprint and carbon footprint. 4. Introduction to the environmental impact assessment
Practice 1: Codification of wastes	
Practice 2: Preparation of immobilized activated charcoal for use as an adsorbent.	
Practice 3: Contaminants removal by adsorption with immobilized activated charcoal.	
Practice 4: Coagulation-flocculation: Establishment of optimal working conditions.	
Practice 5: Simulation of certain stages of a EDAR .	
Practice 6: Life Cycle Analysis of a product.	

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Problem solving	11	22	33
Laboratory practical	12	12	24
Report of practices, practicum and external practices	0	6	6
Case studies	0	6	6
Objective questions exam	1.5	0	1.5

Problem and/or exercise solving	1.5	0	1.5

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

Methodologies

	Description
Lecturing	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	Training and Learning Results
Report of practices, practicum and external practices	Detailed report for each practices that includes an explanation of the experimental work, as well as the results obtained, their analysis and the conclusions drawn from them. The laboratory practices are in teams of 2 students, but the teacher may require the report to be submitted individually. A report submitted by a student who did not previously do the practical in the laboratory will not be evaluated under any circumstances. In the computer classroom practices, each student will work individually and, consequently, the reports will also be individual. Similarly, only the report handed by a student who has previously attended the corresponding practical session will be assessed. 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.	10	B7 C16 D1 D3 D9 D10 D12 D17
Case studies	All exercises, seminars, supervised work that may involve learning and service, 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. Competence CT3 will be assessed base on the two parts of the exam: theory and exercises; considering the precision and clarity of the answers.	30	B7 C16 D2 D3 D10 D12

Objective questions exam	Written tests in which students must answer various theoretical questions related to the subject syllabus. In the semester, two tests will be carried out: one at midterm (T-1) and the other at the end of the course (T-2), both scheduled on dates set by the institution. Both tests will be multiple-choice exams, and in each, students will answer several multiple-choice questions. Each test (T-1 and T-2) will be graded on a scale of 10 points and will represent 50% of the total score for this item CG7, CE16 and CT19 competences will be assessed in this test, based on student responses to the questions. CT1, CT3 and CT10 competences are also evaluated, since the test is written and requires students' analysis and synthesis skills.	30	B7 C16	D1 D3 D10 D19
Problem and/or exercise solving	Written exams that consist of solving several problems related to the subject syllabus. Two exams will be given during the semester□one (P-1) at the midpoint and the other (P-2) at the end of the course□and both will take place on the dates set by the institution. In each exam, students must solve various problems related to the topics covered in the sections subject to evaluation. Each exam (P-1 and P-2) will be graded on a scale of 10 points, and will represent 50% of the total score for this item. CT2, CT9 and CT19 competences will be assessed in this proof, 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 test is written and requires students' analysis and synthesis skills.	30		D1 D2 D3 D9 D10 D19

Other comments on the Evaluation

Evaluation

FIRST CALL

1. Continuous Assessment Modality

A student is considered to be following the "continuous assessment modality" as long as they have not officially renounced this evaluation format □that is, provided they did not officially request a change to the □global assessment modality□ within the deadlines set by the E.E.I. management.

The final grade of students under the "continuous assessment modality" will be based on the following criteria:

a) *Mandatory completion of all scheduled tests* under "*Objective Question Exam***" (T-1 and T-2) and "***Problem and/or Exercise solving***" (P-1 and P-2)":**

- Each test will be graded on a 10-point scale, and a minimum of 5 points is required to pass.
- A student will not pass the subject if they score less than 4 points on any of the tests (T-1, T-2, P-1 or P-2).

b) ***Mandatory completion of "Laboratory Practices"*** *and submission of the corresponding reports*:

- Practices are graded on a 10-point scale, and a minimum of 5 points is required to pass.
- Students will not pass if they score less than 4 points.
- In addition, students may not be unjustifiably absent from more than one lab practice. If they miss more than one, they must take an exam covering the missed practices

c) ***Students meeting the conditions in (a) and (b) will pass the subject if the weighted sum of all evaluation scores in this guide is ≥ 5 points.***

Regarding the "Objective Question Exa" and "Problem and/or exercise solving tests:

- **T-1** and **P-1** will be held on the same day, mid-semester, on a date set by the E.E.I. Students will answer theoretical questions and solve problems based on the first three topics of the course syllabus.
- If a student scores under 4 points in either T-1 or P-1, but passes the other, they must retake only the failed part in the July extraordinary call.

- **T-2** and **P-2**will take place on the same day at the end of the semester, according to the E.E.I. schedule for final exams. These tests will cover the last three topics of the syllabus.
- If a student scores under 4 points in either T-2 or P-2 but passes the other, they will also only need to repeat the failed part in the July extraordinary call.

2. Global Assessment Modality

Students granted a change to the global assessment modality by the E.E.I. will take a final exam covering theory and problem-solving (Objective Question Exam + Problem and/or Exercise solving), which will count for 90% of the final grade. A practical exam will account for the remaining 10%. In all cases, students must score at least 50% of the maximum score in each part - i.e., theory, problem-solving, and practices- in order to pass the subject.

SECOND or EXTRAORDINARY CALL

The same evaluation criteria will apply.

Regarding the July exam, the grades for case studies and Report of Practices will be retained, as long as the required minimum grade was achieved in the first call.

If a student passed any test in the first call (T-1, T-2, P-1 or P-2) with a score ≥ 5, they will only need to retake the failed tests in July

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
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Tchobanoglous, G., **Gestión integral de residuos sólidos**, McGraw-Hill, 1996
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Sharma, H. D., and Reddy, K. R., **Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies**, John Wiley & Sons, 2004
Wark and Warner, **Contaminación del aire: origen y control**, Limusa, 1996

Jonker, G. y Harmsen, J., **Ingeniería para la sostenibilidad**, Reverté, 2014
Azapagic, A. and Perdan S., **Sustainable development in practice: Case studies for engineers and scientists**, Wiley, 2011
Reddy, K.R., Cameselle, C. and Adams, J.A., **Sustainable Engineering: Drivers, Metrics, Tools, and Applications**, Wiley, 2019

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Chemical technology/V12G360V01606
Chemistry: Chemistry/V12G380V01205

Other comments

Recommendations:
To enroll in this subject is necessary to have passed or be enrolled in all subjects of previous courses to the course that is located this subject.

IDENTIFYING DATA				
Thermal technology				
Subject	Thermal technology			
Code	V12G363V01704			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	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.			

Training and Learning Results	
Code	
B4	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.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
B11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
C7	CE7 Knowledge of applied thermodynamics and heat transfer. Basic principles and their application to solving engineering problems.
D2	CT2 Problem solving.
D7	CT7 Ability to organize and plan.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

Expected results from this subject	Training and Learning Results		
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.	B4 B5	C7	D2 D9
Understanding the fundamentals of combustion	B4 B5 B7	C7	D2 D7 D9
Understanding the fundamentals of heat engines	B4 B5 B7	C7	D2 D7 D9
Understanding the fundamentals of a thermal power plant operation	B4 B5 B6 B11	C7	D2 D9 D10 D17 D20

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	Training and Learning Results		
Mentored work	Delivery of the reports of the work carried out and oral presentation of the same. Resolution of problems raised during the course.	20	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20
Problem and/or exercise solving	Partial exams taken along the course during class hours.	40	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20
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.	40	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20

Other comments on the Evaluation

The coursecan be passed through two modalities:

A) Modality by Continuous Evaluation.

The final grade (FG) of the student will be determined by adding the points obtained in the successive activities of continuous assessment (problem solving with argued answer, test type test, test of objective questions, theoretical issues, etc.), both face-to-face and telematic, developed throughout the course. Each enrollment in the subject, in the course, implies the resetting to zero of the grades in the continuous evaluation activities obtained in previous courses. The students subject to the Continuous Evaluation modality who present themselves to any evaluable activity included in the Teaching Guide of the course will be considered as "presented" and will be taken into account for the final grade.

All school days will be considered susceptible and likely to include some continuous assessment activity. These activities will

be notified sufficiently in advance, and will be carried out within the school timetable approved by the center, during the classroom sessions and/or problem and/or laboratory sessions that take place throughout the course. In case of insufficient means, the faculty will articulate the planning mechanism that guarantees the best adjustment to the schedule. The realization of these activities of continuous evaluation will be governed in time/conditions established by the professor.

There will be partial tests during the course (PT), with a weight of 40% of the overall grade and a final exam (EF), with a weight of 40% of the overall grade, which will be held on the official date set for the exam.

The delivery of work or activities carried out during the course (T) will also be evaluated with a weight of 20%.

In the partial exams, isolated parts of the syllabus will be evaluated. In the final exam (FE) all the course material will be evaluated.

In the final exam a minimum grade of 4 out of 10 will be required to pass the course.

Therefore: FG = 0,4·PT + 0,2·T + 0,4·FE

* If the FG grade exceeds 5 points out of 10 but the FE grade is lower than 4 points, thefinal grade will be "suspense" with a numerical grade of 4,9.

B) Global Evaluation Mode.

Those students who choose the globa levaluation modality must officially obtain the waiver of the continuous evaluation modality, using the channels provided by the school, and will be evaluated within the official testing period (first and second opportunity) marked in the academic calendar of the course on the official dates set by the center. This global evaluation modality will take into account all the contents taught in the subject, both those taught in theory classes, problem sessionsand laboratory practices, and will represent 100% of the maximum grade.

In any case, in order to obtain a passing grade, the final grade must reach a minimum of 5 points out of 10.

Second chance exam.

Students who have not passed the course afterthe first opportunity, will be evaluated in the second opportunity of all the contents taught in the subject, both those taught in the theory classes, problem sessions and laboratory practices, and will represent 100% of the maximum grade.

EXTRAORDINARY SCHOOL-LEAVING EXAMS

The format of the exam may be different from the one detailed above. It will be carried out by means of a written exam in which the most relevant aspects of the subject will be addressed, both in theoretical issues and through numerical resolution problems that will allow to obtain 100% of the evaluation and a minimum of 50% must be reached to pass the subject.

It will not be allowed, in all tests, either considered continuous assessment or global assessment, the use of electronic devices such as tablet, smartphone, smartwatch, laptop, etc. or similar unauthorized devices.

Ethical commitment.

The student is expected to exhibit appropriate ethical behavior. If unethical behavior isdetected (copying, plagiarism, use of unauthorized electronic devices, etc.), the student will be considered ineligible to pass the course. In this case, the overall grade for the current academic year will be a failing grade (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 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	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C21	CE21 Knowledge of electric systems of power and their applications
D2	CT2 Problem solving.
D6	CT6 Application of computer science in the field of study.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
New	B3	C21	D2 D6 D10 D14 D16 D17
(*)Documentación, elaboración, presentación y defensa del proyecto de una instalación		C21	D2 D6 D10 D17

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	Training and Learning Results		
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.	15	B3	C21	
Essay questions exam	Justification and documentation of the cases proposed.	25	B3	C21	D2 D10
Laboratory practice	Delivery of memories of practices and/or results of the same	25	B3	C21	D6 D10 D16 D17
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.	35	B3	C21	D2 D6 D10 D14 D16 D17

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	Choose	Year	Quadmester
	6	Mandatory	4	2c
Teaching language	Castelán			
Department	Enxeñaría de sistemas e automática			
Coordinator	López Prieto, Miguel Ángel			
Lecturers	Falcón Oubiña, Pablo Fernández Silva, Celso López Prieto, Miguel Ángel			
E-mail	miguel.lopez.prieto@uvigo.gal			
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.			

Resultados de Formación e Aprendizaxe	
Code	
B3	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.
C24	CE24 Coñecementos de regulación automática e técnicas de control, e a súa aplicación á automatización industrial.
D9	CT9 Aplicar coñecementos.
D16	CT16 Razoamento crítico.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecementos xerais sobre o control dixital de sistemas dinámicos, das principais ferramentas de simulación de sistemas *muestreados	B3		
Capacidade para deseñar sistemas de regulación e control dixital.		C24	D9
Habilidade para a concibir, desenvolver e *modelar sistemas automáticos.		C24	D9 D16
Capacidade de analizar as necesidades dun proxecto de automatización e fixar as súas especificacións.			D9 D16 D17
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.		C24	D9 D16
Capacidade de traducir un modelo de funcionamento a un programa de autómata.		C24	D9
Ser capaz de integrar distintas tecnoloxías (electrónicas, eléctricas, *neumáticas, etc.) nunha única automatización.	B3	C24	D9 D17

Contidos	
Topic	
TEMA 1.- Autómatas Programables Industriais (PLCs).	1.1 Principio de funcionamento. 1.2 Memoria de Entradas e Memoria de Saídas. 1.3 Ciclo de funcionamento do autómata. Tempo de ciclo. 1.4 Programación estruturada. Tipos de módulos de programa.
TEMA 2.- Linguaxes normalizadas para a programación de autómatas.	2.1 Programación de autómatas co Standard IEC 61131. 2.2 Tipos de Datos Numéricos. Limitacións. Conversión. 2.3 Programación avanzada en Diagrama de Funcións e Diagrama de Contactos. Ampliación do conxunto de instrucións coñecidas.
TEMA 3.- Supervisión e Control de Procesos Industriais.	3.1 Tratamento de sinais analóxicos de E/S no autómata. 3.2 Modelado de sistemas de supervisión e/ou control. 3.3 Do modelo funcional ao programa de autómata. 3.4 Integración de Tecnoloxías.

TEMA 4.- Sistemas de control dixital.	4.1 Esquemas de control por computador. 4.2 Secuencias e sistemas discretos. 4.3 Transformada Z. 4.4 Función de transferencia en Z. 4.5 Ecuacións en diferenzas.
TEMA 5.- Análise de sistemas muestreados de control.	5.1 Mostraxe. 5.2 Reconstrución. 5.3 Sistemas muestreados. 5.4 Estabilidade. 5.5 Análise de resposta transitoria. 5.6 Análise de resposta permanente.
TEMA 6.- Síntese de reguladores dixitais.	6.1 Discretización de reguladores continuos. 6.2 Reguladores PID discretos.
P1. Tia Portal para supervisión e control de procesos.	Repaso e ampliación do programa Tia Portal para a supervisión e control de procesos.
P2. Supervisión de Procesos con sinais analóxicos.	Modelado e implantación da Supervisión dun proceso sinxelo que teña varios sinais analóxicos de entrada.
P3. 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.
P4. 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.
P5. Matlab e Simulink para Sistemas Discretos.	Repaso e ampliación do programa Matlab e Simulink para a análise e deseño de sistemas de control.
P6. Introdución aos Sistemas Dixitais.	Procedementos de Mostraxe e Reconstrución. Influencia do período de mostraxe.
P7. Análise Dinámica de Sistemas Dixitais.	Obtención da resposta temporal dun sistema discreto. Implantación de Ecuacións en Diferenzas para a simulación de sistemas.
P8. Síntese de Reguladores Discretos.	Discretización de reguladores continuos: comparación dos diversos métodos de discretización. Implantación dun PID discreto.

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	Training and Learning Results
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	B3 C24 D9 D16 D17
Exame de preguntas de desenvolvemento	Exame final dos contidos da materia, que incluirá cuestións teóricas, problemas e exercicios.	70	B3 C24 D9 D16

Other comments on the Evaluation

EXAMENES: 70%

- Dúas probas escritas, a de avaluación continua e o exame final, de 35% de peso cada unha.

- Nota mínima para aprobar cada parte: 5 puntos (sobre 10 puntos).

- O exame de avaluación continua tratará sobre os temas da parte de automatización.

- O exame final tratará sobre os temas da parte de control dixital.

PRÁCTICAS: 30%

- A asistencia a todas as sesións de prácticas é Obrigatoria, excepto para os alumnos cuxa renuncia á Evaliación Continua sexa oficialmente admitida.

- A nota mínima de prácticas é de 3.3 puntos (sobre 10 puntos)

- Se realizará unha Evaluación Continua do traballo do alumnado nas sesións de prácticas ao longo do cuadrimestre. Si un/a alumno/a non prepara adecuadamente as prácticas e/ou descoñece os coñecementos básicos explicados en clase para a realización da mesma, obtendrá directamente a cualificación de suspenso coa mínima nota en dita práctica.

- Si ao longo das sesións de prácticas reglamentadas o traballo do alumno é insuficiente e non consegue o Aprobado en prácticas, tería as prácticas Suspensas para a 1ª convocatoria.

- Si supera o exame escrito na 2ª oportunidade, o alumno deberá examinarse de prácticas si non as ten aprobadas da 1ª oportunidade.

- Tamén deberá examinarse de prácticas, na mesma convocatoria en que superen o exame escrito, os alumnos cuxa renuncia a Evaluación Continua sexa oficialmente admitida.

AVALIACIÓN SEGUNDA OPORTUNIDADE

- Unha única proba escrita sobre todos os contidos vistos durante o curso.

- Se o alumno aproba algunha parte (Automatización ou Control) en 1ª oportunidade se garda para 2ª oportunidade.

CUALIFICACIÓN:

- Para a consideración de "Presentados" ou "Non presentados" a unha convocatoria, se terá unicamente en conta a

participación nas probas escritas.

- Nas probas escritas poderase establecer unha puntuación mínima nun conxunto de preguntas/exercicios para superar o mesmo. Para aprobar a materia débense superar ambas as partes, tanto o programa de prácticas (obtendo como mínimo o 33% da puntuación asignada ás prácticas) como as probas escritas (obtendo como mínimo o 50% da puntuación asignada), obtenindose en principio a nota total segundo a porcentaxe 30%-70% indicado anteriormente.

- No caso dos Suspensos por non alcanzar algún dos mínimos establecidos ou non aprobar os exámenes escritos ou as prácticas, a nota final que figurará na acta será a mínima entre 4.5 e a media obtida de tal forma que nunca poderá superar os 4.5 puntos.

- Se poderían expor actividades adicionais, de caracter voluntario, que complementen a cualificación calculada en base aos criterios expresados anteriormente.

Compromiso ético:

Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (por exemplo copia ou plaxio, 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 do Regulamento Disciplinario da Escola para o alumno/a en cuestión.

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

K. Ogata, **Sistemas de Control en Tiempo Discreto**, 2ª edición, Prentice-Hall, 1996

STEP 7 y WinCC Engineering V18, SIEMENS,

S7-1500 CPU1512C-1PN Manual de producto, SIEMENS,

S7-1500, ET 200MP, ET 200SP, ET 200AL, ET 200pro, ET 200eco PN Procesamiento de valores analógicos, 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	Choose	Year	Quadmester
	6	Mandatory	4	2c
Teaching language	Castelán Galego			
Department	Organización de empresas e márketing			
Coordinator	Urgal González, Begoña			
Lecturers	González Santamaría, Pedro 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.			

Resultados de Formación e Aprendizaxe	
Code	
B9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
D5	CT5 Xestión da información.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
□ 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.	B9	D5 D8 D9
Coñecemento sobre os fundamentos da empresa e das ferramentas específicas para a súa análise financeira.	B9	D5 D8 D9
Coñecemento sobre os fundamentos da administración e dirección de empresas e os procesos de xestión	B9	D5 D8 D9

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 INFORMACIÓN CORPORATIVA
TEMA 5	A TOMA DE DECISIÓNS NA EMPRESA
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	Training and Learning Results	
Prácticas de laboratorio	Resolución de problemas e/ou exercicios mediante a aplicación de rutinas, procedementos e fórmulas a partir da información dispoñible.	20	B9	D5 D8 D9
Exame de preguntas obxectivas	Dúas probas tipo test de escolla múltiple sobre contidos teóricos e prácticos.	50	B9	D5 D8 D9
Exame de preguntas de desenvolvemento	Proba con cuestións teóricas e prácticas, sobre os contidos impartidos ao longo de todo o período formativo.	30	B9	D5 D8 D9

Other comments on the Evaluation

1. AVALIACIÓN CONTINUA

A cualificación final no sistema de avaliación continua determinarase a través das seguintes probas e actividades:

- **Proba 1.** Este exame será tipo test, realizarase ao concluír o Tema 3, terá un carácter liberatorio e suporá o **20%** da cualificación final da materia.
- **Proba 2.** Esta proba tamén será tipo test, realizarase ao concluír o período formativo vencellado á materia e suporá o **30%** da cualificación final da mesma.
- **Proba 3.** Este exame consistirá no desenvolvemento de varios problemas, realizarase na data establecida polo Centro para o exame final na convocatoria ordinaria e suporá o **30%** da cualificación final da materia.
- **Prácticas.** O cumprimento das tarefas desenvolvidas durante as prácticas suporá o **20%** da cualificación final da materia.

2. AVALIACIÓN GLOBAL

Para os estudantes que opten por este sistema de avaliación, a cualificación final da materia será a obtida nun exame global que realizarase na data establecida polo Centro na planificación académica. Este exame dará a posibilidade de obter o 100% da cualificación e constará de dúas partes:

- A primeira parte constituirá o 40% da nota final e tratarase dunha proba tipo test que abarcará todos os contidos teóricos e prácticos desenvolvidos ao longo do período formativo vencellado á materia. Unha condición necesaria, aínda que non suficiente, para superar a materia, será obter nesta parte unha puntuación mínima de 5, nunha escala do 0 a 10.
- A segunda parte completará o 60% restante e constará de varios problemas a desenvolver.

3. CONVOCATORIA EXTRAORDINARIA DE XULLO (SEGUNDA OPORTUNIDADE)

Nesta convocatoria, a cualificación será a obtida nun exame global das mesmas características que o da convocatoria ordinaria.

4. COMPROMISO ÉTICO

Esperase que os estudantes actúen de forma ética e honesta en todas as probas e actividades que se desenvolvan ao longo do período formativo.

No caso de detectar unha actuación fraudulenta nas actividades e probas de avaliación (copia, utilización non autorizada de apuntamentos, libros, materiais, dispositivos electrónicos, medios telemáticos e outros) considerarase que o estudante non reúne os requisitos necesarios para superar a materia. Dito comportamento implicará a cualificación de cero (suspenso) na acta da convocatoria correspondente.

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.

IDENTIFYING DATA				
Compoñentes eléctricos en vehículos				
Subject	Compoñentes eléctricos en vehículos			
Code	V12G363V01902			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	Galego			
Department	Enxeñaría eléctrica			
Coordinator	López Fernández, Xosé Manuel			
Lecturers	López Fernández, Xosé Manuel			
E-mail	xmlopez@uvigo.es			
Web				
General description	(*)La asignatura ofrece una visión introductoria y esencial sobre la electrificación del transporte, destacando tanto la evolución de los vehículos de combustión hacia sistemas electrificados como el papel central que desempeñan los vehículos híbridos y eléctricos en la actual transición energética. Este cambio tecnológico genera nuevas oportunidades para la industria de componentes eléctricos y sectores asociados, como la electrónica, las comunicaciones y la digitalización, y sitúa al vehículo eléctrico en el centro del debate social sobre sostenibilidad, eficiencia energética y modelos económicos. La asignatura invita a reflexionar sobre estos desafíos, proporcionando al alumnado las bases conceptuales necesarias para comprender su impacto y potencial en los ámbitos industrial y tecnológico, estimulándolo a desempeñar un papel activo en este proceso de cambio.			

Resultados de Formación e Aprendizaxe	
Code	
B3	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.
D3	CT3 Comunicación oral e escrita de coñecementos na lingua propia.
D5	CT5 Xestión da información.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia		
Expected results from this subject		Training and Learning Results
Coñecer el desenvolvemento histórico e retos futuros de la rede eléctrica de abordo utilizada nos vehículos (*Kfz *Bornetz)	B3	D3 D5 D10 D17
Coñecer as variantes de rede eléctrica de abordo co aumento de tensión.	B3	D3 D5 D10 D17
Coñecer propiedades, funcionamento e compoñentes que proceden de a rede eléctrica de abordo tradicional en vehículos.	B3	D3 D5 D10 D17

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	Training and Learning Results	
Traballo tutelado	Valoración dos traballos individuais e en equipo, materializados nunha memoria.	40	B3	D3 D5 D10 D17
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	60	B3	D3 D5 D10 D17

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**, 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**, ‎ SAE International, 2016

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

Kevin Jost, **48-Volt Developments**, 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	Choose	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.			

Training and Learning Results	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
D1	CT1 Analysis and synthesis.
D4	CT4 Oral and written proficiency in a foreign language.
D7	CT7 Ability to organize and plan.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D18	CT18 Working in an international context.

Expected results from this subject	Training and Learning Results	
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.	B10	D1 D4 D7 D10 D17 D18
To improve students' sense of linguistic awareness of English as a second language, the grammatical and lexical mechanisms and types of expressions.	B10	D1 D4 D7 D10 D17 D18
Improving students' listening and reading skills, as well as their speaking and writing skills.	B10	D1 D4 D7 D10 D17 D18
To upgrade students' grammatical and lexical notions of the English language, and the comprehension of basic Technical English structures.	B10	D1 D4 D7 D10 D17 D18
Promoting students' critical autonomy for the comprehension and understanding of texts, dialogues and oral presentations.	B10	D1 D4 D7 D10 D17 D18

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	Training and Learning Results	
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	B10	D4 D10 D18
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	B10	D1 D10 D18
Essay	Evaluations of the communicative skill of the written expression (Writing).	16	B10	D1 D4 D7 D10 D18
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	B10	D1 D4 D7 D10 D17 D18

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

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	Choose	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.			

Training and Learning Results	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
D1	CT1 Analysis and synthesis.
D4	CT4 Oral and written proficiency in a foreign language.
D7	CT7 Ability to organize and plan.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D18	CT18 Working in an international context.

Expected results from this subject	Training and Learning Results	
To improve students' sense of linguistic awareness of English as a second language, the grammatical and lexical mechanisms and types of expressions.	B10	D1 D4 D7 D9 D10 D17 D18
Improving students' listening and reading skills, as well as their speaking and writing skills in Technical English at intermediate level (B1).	B10	D1 D4 D7 D9 D10 D17 D18
To upgrade students' grammatical and lexical notions of the English language, and the comprehension of basic Technical English structures at B1 level.	B10	D1 D4 D7 D9 D10 D17 D18
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.	B10	D1 D4 D7 D9 D10 D17 D18

Promoting students' critical autonomy for the comprehension and understanding of dialogues and texts written in Technical English.	B10	D1 D4 D7 D9 D10 D17 D18

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. - 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. - Vocabulary for describing trends. - Prepositions.
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. - Describing Trends. - Describing and referring to visual aids. 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. - Cause-effect verbs. - Describing timelines: past simple, present perfect, etc.
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. - 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	Training and Learning Results	
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	B10	D7 D10 D18
Essay	Evaluation of the writing skill.	16	B10	D1 D4 D7 D9 D10 D18
Objective questions exam	Evaluation of the listening skill with engineering-related contents.	16	B10	D4 D9 D10 D18
Oral exam	Evaluation of the speaking skill with engineering-related vocabulary and topics.	32	B10	D1 D4 D7 D10 D17 D18
Objective questions exam	Evaluation of the reading skill with engineering-related topics and vocabulary.	16	B10	D1 D4 D7 D10 D17 D18

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

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 emails or using of mobile phones during the lessons are prohibited.

The student who does not comply with the information in the previous paragraph will also lose the opportunity to follow the continuous assessment process.

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	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Alonso Rodríguez, José Antonio			
Lecturers	Alonso Rodríguez, José Antonio Fernández Álvarez, Antonio González Cespón, José Luis Patiño Barbeito, Faustino			
E-mail	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.			

Training and Learning Results	
Code	
B3	CG3 Knowledge of basic and technological subjects that enable students to learn new methods and theories, and to adapt to new situations.
C18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
D2	CT2 Problem solving.
D3	CT3 Oral and written proficiency in the own language.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D7	CT7 Ability to organize and plan.
D8	CT8 Decision making.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D11	CT11 Planning changes to improve overall systems.
D13	CT13 Adaptability to new situations.
D14	CT14 Creativity.
D15	CT15 Objectification, identification and organization.
D17	CT17 Working as a team.
D18	CT18 Working in an international context.
D20	CT20 Ability to communicate with people not expert in the field.

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

Utilization of methodologies, technics and tools for the organization and management of all technical documents other than engineering projects.	B3	C18	D2 D7 D8 D9 D10 D14 D15 D17
Skills in the utilization of information systems and in the communications in the industrial scope.			D5 D6 D9 D11 D17
Skills to communicate properly the knowledge, procedures, results, abilities in the field of Engineering in Industry.			D3 D13 D17 D18 D20

Contents	
Topic	
Edition and composition of scientific texts - technical	Editors of text Introduction to the language *LaTeX Language *Markdown *Metadatos
Management of the knowledge	Plagiarism Quote and references Bibliography and bibliographic agents Use of bibliography with editors of Managing text of knowledge: *Obsidian *Plugins and staff in *Obsidian
Editorial	Norms and styles of editorial Editorial and preparation of scientific documents - technical. Language *inclusivo
Oral defence of works	Realisation of presentations Language *gestual Protocol Presentation and defence of works *academicos

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	10	40	50
Practices through ICT	20	23.5	43.5
Presentation	5	5	10
Workshops	15	20	35
Laboratory practice	2.5	0	2.5
Problem and/or exercise solving	3	0	3
Presentation	2	0	2
Essay	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	Class *expositiva of the professor with support of visual material and of Tics
Practices through ICT	The methodology of practices with support of TIC focuses in the autonomous learning of the student through the TIC, and in the cooperative work between student and professor.
Presentation	The professor explains with the example, making a presentation of as it has to make an oral exhibition.
Workshops	A workshop is a class of instruction or of information that centres in the education of skilled technicians or in the study of a subject in specific.

Personalized assistance

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practice	Realisation of proofs and practical exercises related with the contents of the matter, in the frame of the personalised attention to the students.	25	B3 C18 D2 D3 D5 D7 D8 D9 D10 D13 D14 D15 D17 D18 D20
Problem and/or exercise solving	Resolution of exercises related with the subject of management of the knowledge and of bibliographic management, appointments and references.	25	B3 C18 D2 D3 D7 D8 D9 D11 D14 D15
Presentation	Preparation and oral exhibition of a subject proposed by the *profesorado	25	
Essay	Preparation of one or several works of type *cientifico-technical proposed by the *profesorado and with application of all the exposed in the subject.	25	

Other comments on the Evaluation

to) Modality of Continuous Evaluation:In each one of the items indicated will be precise to take out a minimum note of 4 on 10. Of not being like this, the student will have to go back to examine of the item suspense.&*nbsp;*b) Modality of global Evaluation:The student will be able to surpass the subject in a consistent global evaluation in:Preparation of a scientific document-technical with *LaTeX. (40%)Preparation of a clear-cut structure in a vault of *Obsidian (30%)Preparation of a presentation and oral exhibition of&the same *nbsp; &*nbsp;(30%)In each one of the proofs indicated, will be precise to take out a minimum note of 4 on 10. Of not being like this, the student will have to go back to examine of the item suspense.&*nbsp;ethical Commitment: expects that the present student a suitable ethical behaviour. In the case to detect a no ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices, and others) considers that the student does not gather the necessary requirements to surpass the matter. In this case the global qualification in the current academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

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	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Enxeñaría de sistemas e automática			
Coordinator	López Fernández, Joaquín			
Lecturers	López Fernández, Joaquín			
E-mail	joaquin@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.			

Resultados de Formación e Aprendizaxe

Code	
B3	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.
B4	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.
C3	CE3 Coñecementos básicos sobre o uso e programación dos ordenadores, sistemas operativos, bases de datos e programas informáticos con aplicación en enxeñaría.
D2	CT2 Resolución de problemas.
D5	CT5 Xestión da información.
D6	CT6 Aplicación da informática no ámbito de estudo.
D7	CT7 Capacidade de organizar e planificar.
D17	CT17 Traballo en equipo.

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
Coñecementos informáticos avanzados aplicables ao exercicio profesional dos futuros enxeñeiros, con especial énfase nas súas aplicacións á resolución de problemas no ámbito da Enxeñaría	B3 B4	C3	D2 D5 D6 D7 D17
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	B3 B4	C3	D2 D5 D6 D7 D17
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	B3 B4	C3	D2 D5 D6 D7 D17
Coñecer os fundamentos do proceso de desenvolvemento de software e as súas diferentes etapas	B3 B4	C3	D2 D5 D6 D7 D17
Capacidade para desenvolver interfaces gráficas de usuario	B3 B4	C3	D2 D5 D6 D7 D17

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. Interfaces de usuario para instalacións industriais.
Creación de aplicacións industriais 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. Desenvolvemento de aplicacións para control e monitorización de plantas industriais.

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 a tódalas dúbidas prantexadas polo alumnado
Prácticas de laboratorio	Atención personalizada a tódalas dúbidas prantexadas polo alumnado
Resolución de problemas	Atención personalizada a tódalas dúbidas prantexadas polo alumnado
Tests	**Description**
Informe de prácticas, prácticum e prácticas externas	Atención personalizada a tódalas dúbidas prantexadas polo alumnado

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Avaliarase as solucións achegadas polo alumno na resolución das diferentes prácticas de laboratorio propostas	40	B3 B4	C3	D2 D5 D6 D7 D17
Resolución de problemas	Cualificarase a aplicación dos coñecementos adquiridos na resolución de tarefas de enxeñería específicas	30	B3 B4	C3	D2 D5 D6 D7 D17
Lección maxistral	Avaliarase a participación activa do alumno nas diferentes actividades formativas	10	B3 B4	C3	D2 D5 D6 D7 D17
Informe de prácticas, prácticum e prácticas externas	Calidade dos informes das diferentes prácticas propostas e das solucións achegadas	20	B3 B4	C3	D2 D5 D6 D7 D17

Other comments on the Evaluation

Poderanse propoñer actividades complementarias, de carácter voluntario, que complementen a nota calculada en función dos criterios expresados anteriormente.

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 e para alumnos que renuncien á avaliación continua, 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	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Gullón Estévez, Beatriz			
Lecturers	Gullón Estévez, Beatriz			
E-mail	bgullon@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.			

Resultados de Formación e Aprendizaxe	
Code	
B4	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.
B6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
B7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
B11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
D2	CT2 Resolución de problemas.
D5	CT5 Xestión da información.
D7	CT7 Capacidade de organizar e planificar.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D14	CT14 Creatividade.
D17	CT17 Traballo en equipo.
D20	CT20 Capacidade para comunicarse con persoas non expertas na materia.

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
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.	B6 B11	D5
CG2 Capacidade para a dirección das actividades obxecto dos proxectos de enxeñaría descritos na competencia CG1.	B11	D5 D9 D10
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.	B4 B7	D2 D5 D9 D10 D14 D17 D20
CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación necesaria no exercicio da profesión de Enxeñeiro Técnico Industrial.	B4 B6 B7 B11	D2 D7 D8 D9 D10 D14 D17 D20

CT1 Análise e síntese.	B4 B7	D2 D5 D7 D8 D9 D14 D17 D20

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	2	15	17
Resolución de problemas e/ou exercicios	2	10	12

*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	Training and Learning Results	
Resolución de problemas	Proporase ao alumno unha seria de problemas que terá que resolver	30	B4 B6 B7	D2 D5 D8 D9 D10 D14 D17
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	40	B11	D5 D7 D8 D9 D10
Resolución de problemas e/ou exercicios	A finalidade de esta proba de desenvolvemento, que terá lugar na semana previa á semana dos exames da Escola, é a resolución dun caso práctico que deberán resolver os alumnos de modo que se aplique de maneira práctica os coñecementos adquiridos	30		

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	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish English			
Department				
Coordinator	Pou Saracho, Juan María			
Lecturers	Barro Guizán, Óscar Pou Álvarez, Pablo Pou Saracho, Juan María Vilas Iglesias, Ana María			
E-mail	jpou@uvigo.es			
Web				
General description	(*)Introduction to laser technology and its applications for undergraduate students of the industrial field.			

Training and Learning Results	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results	
- 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.	B10	D10

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	Training and Learning	Results
Essay questions exam	Several tests consisting of development questions will be proposed, so that no test exceeds 40% of the overall grade for the subject..	70	B10	D10
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	B10	D10
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	B10	D10

Other comments on the Evaluation

If some student was resigning officially the continuous assessment, 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	Choose	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	Choose	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Física aplicada			
Coordinator	Trillo Yáñez, María Cristina			
Lecturers	Trillo Yáñez, María Cristina			
E-mail	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.			

Resultados de Formación e Aprendizaxe	
Code	
B1	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.
B2	CG2 Capacidade para dirixir actividades relacionadas coa competencia CG1.
B3	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.
B4	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.
B10	CG10 Capacidade para traballar nun medio multilingüe e multidisciplinar.
B12	CG12 Capacidade para a integración das competencias CG1 a CG11 nos traballos e proxectos relacionados coas Tecnoloxías Industriais.
D4	CT4 Comunicación oral e escrita de coñecementos en lingua estranxeira.
D12	CT12 Habilidades de investigación.
D13	CT13 Adaptación a novas situacións.

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
Procura, ordenación e estructuración de información sobre calquera tema.	B1 B2 B3 B4 B10 B12	D12
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.	B1 B2 B3 B4 B10 B12	D4 D12 D13
Deseño de equipos, prototipos, programas de simulación, etc, segundo especificacións.	B1 B2 B3 B4 B10 B12	D12
No momento de realizar a solicitude da defensa do TFG, o alumno deberá xustificar a adquisición dun nivel adecuado de competencia en lingua inglesa.		D4

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	Training and Learning Results	
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	B1 B2 B3 B4 B10 B12	D4 D12 D13
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	B1 B2 B3 B4 B10 B12	D4 D12 D13

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	Choose	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.			

Resultados de Formación e Aprendizaxe	
Code	
B1	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.
B2	CG2 Capacidade para dirixir actividades relacionadas coa competencia CG1.
B3	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.
B4	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 previstos na materia	
Expected results from this subject	Training and Learning Results
Capacidade para adaptarse ás situacións reais da profesión.	B1 B2 B3 B4
Integración en grupos de traballo multidisciplinares.	B2 B3 B4
Responsabilidade e traballo autónomo.	B1 B2 B3 B4

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	Training and Learning Results
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	B1 B2 B3 B4

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