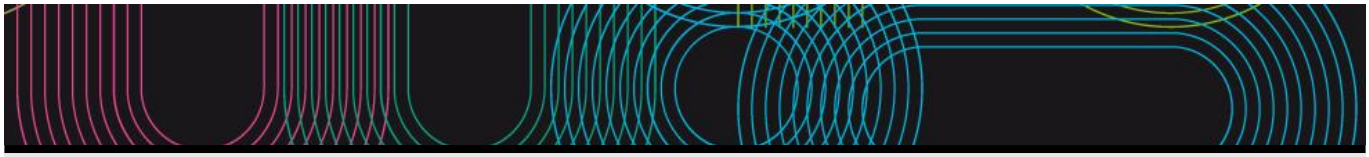

(*)Escola de Enxeñaría Industrial

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

Grado en Ingeniería en Química Industrial

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V12G350V01101	Graphic expression: Fundamentals of engineering graphics	1st	9
V12G350V01102		1st	6
V12G350V01103		1st	9
V12G350V01104		1st	6
V12G350V01201	Business: Introduction to business management	2nd	6
V12G350V01202		2nd	6
V12G350V01203	Computer science: Computing for engineering	2nd	6
V12G350V01204		2nd	6
V12G350V01205	Chemistry: Chemistry	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V12G350V01301	Thermodynamics and heat transfer	1st	6
V12G350V01302	Fundamentals of electrical engineering	1st	6
V12G350V01303	Mechanism and machine theory	1st	6
V12G350V01304	Fundamentals of manufacturing systems and technologies	2nd	6
V12G350V01305	Materials science and technology	1st	6
V12G350V01401	Fluid mechanics	2nd	6
V12G350V01402	Electronic technology	2nd	6
V12G350V01403	Automation and control fundamentals	1st	6
V12G350V01404	Mechanics of materials	2nd	6

V12G350V01405	Chemical engineering 1	2nd	6

Year 3rd			
Code	Name	Quadmester	Total Cr.
V12G350V01501	Basics of operations management	1st	6
V12G350V01502	Environmental technology	1st	6
V12G350V01503	Chemical engineering 2	1st	6
V12G350V01504	Industrial chemistry	1st	6
V12G350V01505	Experimentation in industrial chemistry 1	1st	6
V12G350V01601	Reactors and biotechnology	2nd	9
V12G350V01602	Experimentation in industrial chemistry 2	2nd	6
V12G350V01603	Control and instrumentation in chemical processes	2nd	9
V12G350V01604	Technical Office	2nd	6

Year 4th			
Code	Name	Quadmester	Total Cr.
V12G350V01701	Product optimisation	1st	6
V12G350V01702	Simulation and optimisation of chemical processes	1st	6
V12G350V01902	Electrical components in vehicles	2nd	6
V12G350V01903	Technical english 1	2nd	6
V12G350V01904	Technical english 2	2nd	6
V12G350V01905	Methodology for the preparation, presentation and management of technical projects	2nd	6
V12G350V01906	Advanced programming for engineering	2nd	6
V12G350V01907	Safety and industrial hygiene	2nd	6
V12G350V01908	Laser technology	2nd	6
V12G350V01911	Plant integration in business management	1st	9
V12G350V01912	Management and implementation of chemical plants and processes	1st	9
V12G350V01913	Heating and cooling in the process industry	2nd	6
V12G350V01914	Design of chemical and processing plants	2nd	6
V12G350V01921	Bioelectrochemistry	1st	6
V12G350V01922	Biotechnological processes and products	1st	6
V12G350V01923	Industrial organic chemistry	1st	6
V12G350V01924	Modelling of biotechnological processes	2nd	6
V12G350V01925	Environmental management techniques	2nd	6

V12G350V01981	Internships: Internships in companies	2nd	6
V12G350V01991	Final Year Dissertation	2nd	12
V12G350V01999	Internships/elective	2nd	6

IDENTIFYING DATA				
Graphic expression: Fundamentals of engineering graphics				
Subject	Graphic expression: Fundamentals of engineering graphics			
Code	V12G350V01101			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
C5	CE5 Capacity for spatial vision and knowledge of the techniques of graphic representation, using traditional methods of metric geometry and descriptive geometry, and through the application of computer-aided design.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.

Expected results from this subject	Training and Learning Results		
- Know, understand, and apply a body of knowledge about the basics of drawing and standardization of industrial engineering, in its broadest sense , while promoting the development of space capacity.	B3 B4	C5	D6
Purchase the capacity for the abstract reasoning and the establishment of strategies and efficient procedures in the resolution of the graphic problems inside the context of the works and own projects of the engineering.	B3 B4	C5	D2
Use the graphic communication between technicians, by means of the realisation and interpretation of planes in accordance with the Norms of Technical Drawing, involving the use of the new technologies.	B6	C5	D6 D9
Assume a favourable attitude to the permanent learning in the profession, showing *proactivo, participatory and with spirit of *superación.	B4		D9

Contents
Topic

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

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.	20-30	B3 C5 D2 B6 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.	30-40	B4 C5 D2 B6 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	20	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.	20	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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Complementary Bibliography

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

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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				
(*)Física: Física I				
Subject	(*)Física: Física I			
Code	V12G350V01102			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
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 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
(*)FB2a. Comprensión y dominio de los conceptos básicos sobre las leyes generales de la mecánica y campos y ondas y su aplicación para la resolución de problemas propios de la ingeniería.	B3	C2	
(*)CG3. Conocimiento en materias básicas y tecnológicas, que les capacite para el aprendizaje de nuevos métodos y teorías, y les dote de versatilidad para adaptarse a nuevas situaciones.		C2	
(*)CS2. Aprendizaje y trabajo autónomos.	B3	C2	D9 D10
New	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

1. CONTINUOUS ASSESSMENT (EC)

Continuous assessment (denoted EC) comprises the mark ECA on the topics covered in the lectures, with a weight of 80% in the final mark, and the mark ECL on the laboratory topics, with a weight of 20% in the final mark: EC = ECA (80%) + ECL (20%).

In the ordinary exam, the mark ECA will be evaluated by means of tests to be taken during the course, with a weight of 40% in the final mark (mark ECC1), and a final test, with a weight of 40% in the final mark (mark ECF1). The mark scheme for the extraordinary exam will be the same as for the ordinary one so that it will comprise two tests, ECC2 and ECF2, equivalent in content and evaluation methodology (objective questions, essay questions and problem solving) to ECC1 and ECF1, respectively.

The mark ECL will be evaluated by means of practices reports, with a weight of 10% in the final mark (mark ECLI), and tests, with a weight of 10% in the final mark (mark ECLE). It is mandatory

the attendance to all lab sessions to obtain the mark ECL, otherwise, the mark ECL will be 0.0.

Final mark EC for the continuous assessment modality:

- Ordinary exam: EC = ECC1 (40%) + ECF1 (40%) + ECLI (10%) + ECLE (10%).

- Extraordinary exam: EC = ECC2 (40%) + ECF2 (40%) + ECLI (10%) + ECLE (10%).

In the extraordinary exam, a student who has previously obtained marks ECC1 or EFC1 (or both) can choose between: a) answering the exam(s) corresponding to mark ECC2 and/or mark EFC2, in such a way that the new mark ECC2 replaces ECC1 and/or the new mark ECF2 replaces ECF1, and b) maintaining mark ECC1 and/or mark ECF1 instead of taking the exam(s) corresponding to mark ECC2 and/or mark ECF2, respectively.

2. GLOBAL ASSESSMENT (EG)

Those students who have been granted the waiver of the continuous assessment have the possibility of taking a written global test to obtain a mark EG with a weight of 100% of the final mark. This test will include the following parts: a test on topics covered in the lectures, with a weight of 80% in the final mark (mark denoted EGA1 in the ordinary exam and EGA2 in the extraordinary exam), and a test on laboratory topics, with a weight of 20% in the final mark (mark denoted EGL1 in the ordinary exam and EGL2 in the extraordinary exam).

Final mark EG for the global assessment modality:

- Ordinary exam: EG = EGA1 (80%) + EGL1 (20%).

- Extraordinary exam: EG = EGA2 (80%) + EGL2 (20%).

In the extraordinary exam, a student who has previously obtained marks EGA1 or EGL1 (or both) can choose between: a)

answering the exam(s) corresponding to mark EGA2 and/or mark EGL2, in such a way that the new mark EGA2 replaces EGA1 and/or the new mark EGL2 replaces EGL1, and b) maintaining mark EGA1 and/or mark EGL1 instead of taking the exam(s) corresponding to mark EGA2 and/or mark EGL2, respectively.

3. END-OF-PROGRAM EXAM (FC)

The end-of-program exam follows the same scheme as the global assessment EG.

Final mark FC for the end-of-program exam:

FC = FCA (80%) + FCL (20%).

4. GENERAL RULES

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

Within the specifications detailed in the preceding sections, the tests and exams 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).

1. CONTINUOUS ASSESSMENT (EC)

Continuous assessment (denoted EC) comprises the mark ECA on the topics covered in the lectures, with a weight of 80% in the final mark, and the mark ECL on the laboratory topics, with a weight of 20% in the final mark: EC = ECA (80%) + ECL (20%).

In the ordinary exam, the mark ECA will be evaluated by means of tests to be taken during the course, with a weight of 40% in the final mark (mark ECC1), and a final test, with a weight of 40% in the final mark (mark ECF1). The mark scheme for the extraordinary exam will be the same as for the ordinary one so that it will comprise two tests, ECC2 and ECF2, equivalent in content and evaluation methodology (objective questions, essay questions and problem solving) to ECC1 and ECF1, respectively.

The mark ECL will be evaluated by means of practices reports, with a weight of 10% in the final mark (mark ECLI), and tests, with a weight of 10% in the final mark (mark ECLE). It is mandatory

the attendance to all lab sessions to obtain the mark ECL, otherwise, the mark ECL will be 0.0.

Final mark EC for the continuous assessment modality:

- Ordinary exam: EC = ECC1 (40%) + ECF1 (40%) + ECLI (10%) + ECLE (10%).

- Extraordinary exam: EC = ECC2 (40%) + ECF2 (40%) + ECLI (10%) + ECLE (10%).

In the extraordinary exam, a student who has previously obtained marks ECC1 or EFC1 (or both) can choose between: a) answering the exam(s) corresponding to mark ECC2 and/or mark EFC2, in such a way that the new mark ECC2 replaces ECC1 and/or the new mark ECF2 replaces ECF1, and b) maintaining mark ECC1 and/or mark ECF1 instead of taking the exam(s) corresponding to mark ECC2 and/or mark ECF2, respectively.

2. GLOBAL ASSESSMENT (EG)

Those students who have been granted the waiver of the continuous assessment have the possibility of taking a written

global test to obtain a mark EG with a weight of 100% of the final mark. This test will include the following parts: a test on topics covered in the lectures, with a weight of 80% in the final mark (mark denoted EGA1 in the ordinary exam and EGA2 in the extraordinary exam), and a test on laboratory topics, with a weight of 20% in the final mark (mark denoted EGL1 in the ordinary exam and EGL2 in the extraordinary exam).

Final mark EG for the global assessment modality:

- Ordinary exam: EG = EGA1 (80%) + EGL1 (20%).

- Extraordinary exam: EG = EGA2 (80%) + EGL2 (20%).

In the extraordinary exam, a student who has previously obtained marks EGA1 or EGL1 (or both) can choose between: a) answering the exam(s) corresponding to mark EGA2 and/or mark EGL2, in such a way that the new mark EGA2 replaces EGA1 and/or the new mark EGL2 replaces EGL1, and b) maintaining mark EGA1 and/or mark EGL1 instead of taking the exam(s) corresponding to mark EGA2 and/or mark EGL2, respectively.

3. END-OF-PROGRAM EXAM (FC)

The end-of-program exam follows the same scheme as the global assessment EG.

Final mark FC for the end-of-program exam:

FC = FCA (80%) + FCL (20%).

4. GENERAL RULES

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

Within the specifications detailed in the preceding sections, the tests and exams 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**, 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				
(*)Matemáticas: Álxebra e estatística				
Subject	(*)Matemáticas: Álxebra e estatística			
Code	V12G350V01103			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
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 Problems resolution.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.

Expected results from this subject	Training and Learning Results		
Acquire the basic knowledge on matrices, vector spaces and linear maps.	B3	C1	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	B3	C1	D2
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.	B3	C1	D2 D9
Perform basic exploratory analysis of databases.	B3	C1	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.	B3		D2 D6

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				
(*)Matemáticas: Cálculo I				
Subject	(*)Matemáticas: Cálculo I			
Code	V12G350V01104			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.
D14	CT14 Creativity.
D16	CT16 Critical thinking.

Expected results from this subject	Training and Learning Results		
(*)	B3	C1	D1
(*)	B3	C1	D1
(*)	B3 B4	C1	D2 D9 D14 D16
(*)	B3 B4	C1	D1 D2 D9 D14 D16
(*)	B4	C1	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	V12G350V01201			
Study programme	Grado en Ingeniería en Química Industrial			
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 Problems resolution.
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				
(*)Física: Física II				
Subject	(*)Física: Física II			
Code	V12G350V01202			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
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 Problems resolution.
D9	CT9 Apply 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,
3en. Serway R. A., Jewett J. W, **Physics for Scientists and Engineers**, 9th ed., Brooks/Cole,
4. Juana Sardón, J. M., **Física general, V1 y V2**, 2ª ed., Pearson Prentice-Hall,
5. Bronshtein, I., Semendiaev, K., **Manual de matemáticas para ingenieros y estudiantes**, 4ªed., MIR 1982; MIR-Rubiños 1993,
5en. Bronshtein, I., Semendiaev, K., **Handbook of Mathematics**, 5th Ed., Springer Berlin,
6. Jou Mirabent, D., Pérez García, C., Llebot Rabagliati, J. E., **Física para ciencias de la vida**, 2ª ed., McGraw-Hill Interamericana de España S.L.,
7. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos**, 1ª ed., ECU,
8. Cussó Pérez, F., López Martínez, C., Villar Lázaro, R., **Fundamentos Físicos de los Procesos Biológicos, Volumen II**, 1ª ed., ECU,
9. Villar Lázaro, R, López Martínez, C., Cussó Pérez, F., **Fundamentos Físicos de los Procesos Biológicos, Volumen III**, 1ª ed., ECU,
10en. Villars, F., Benedek, G. B., **Physics with Illustrative Examples from Medicine and Biology**, 2nd ed., AIP Press/Springer-Verlag,

Recommendations

Other comments

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

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

IDENTIFYING DATA				
Computer science: Computing for engineering				
Subject	Computer science: Computing for engineering			
Code	V12G350V01203			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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 Problems resolution.
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

Eric Matthes, **Python Crash Course, 3rd Edition: A Hands-On, Project-Based Introduction to Programming**, 3, No Starch Press, 2022

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

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

Complementary Bibliography

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

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

Recommendations

IDENTIFYING DATA				
Matemáticas: Cálculo II e ecuacións diferenciais				
Subject	Matemáticas: Cálculo II e ecuacións diferenciais			
Code	V12G350V01204			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego Inglés			
Department	Matemática aplicada I Matemática aplicada II			
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	O obxectivo que se persegue con esta materia é que o alumno coñeza as técnicas básicas do cálculo integral en varias variables, cálculo *vectorial, ecuacións diferenciais ordinarias e as súas aplicacións.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C1	CE1 Capacidade para a resolución dos problemas matemáticos que poidan presentarse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral e escrita de coñecementos.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D15	CT15 Obxectivación, identificación e organización.
D16	CT16 Razoamento crítico.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Comprensión de os conceptos básicos de o cálculo integral en varias variables.	B3	C1	D1
Coñecemento de as principais técnicas de integración de funcións de varias variables.	B3 B4	C1	D1 D2 D9
Coñecemento de os principais resultados de o cálculo vectorial e aplicacións.	B3 B4	C1	D1 D2 D9
Adquisición de os coñecementos básicos para a resolución de ecuaciones e sistemas diferenciales lineais.	B3 B4	C1	D1 D2 D9

Comprensión de a importancia de o cálculo integral, cálculo vectorial e de as ecuaciones diferenciales para o estudo de o mundo físico.	C1	D9 D16
Aplicación de os coñecementos de cálculo integral, cálculo vectorial e de ecuaciones diferenciales.	C1	D2 D6 D9 D16
Adquisición de a capacidade necesaria para utilizar estes coñecementos en a resolución manual e informática de cuestións, exercicios e problemas.	C1	D1 D2 D3 D6 D9 D15 D16

Contidos	
Topic	
Integración en varias variables.	Integral dobre sobre rectángulos. Redución a integrais iteradas. Integral dobre sobre rexións elementais. Propiedades. Teorema de Fubini. Teorema do cambio de variable. Caso particular de coordenadas polares. Integral triple sobre unha caixa e sobre rexións elementais. Teorema de Fubini. Teorema do cambio de variable. Casos particulares: coordenadas cilíndricas e esféricas. Aplicacións xeómetricas e físicas da integral múltiple: cálculo de volumes, centros de masa e momentos de inercia.
Cálculo vectorial	Curvas no plano e no espazo. Lonxitude de arco. Cambio de parámetro. Integral curvilínea ou de traxectoria con respecto á lonxitude de arco de campos escalares. Integral curvilínea ou circulación de campos vectoriales. Propiedades. Teorema fundamental das integrais de liña. Teorema de Green no plano. Superficies regulares. Plano tanxente. Vector normal. Área dunha superficie. Integral de superficie de campos escalares. Fluxo ou integral de superficie de campos vectoriales. Operadores diverxencia e rotacional. Caracterización de campos conservativos. Teorema de Stokes. Teorema de Gauss.
Ecuacións diferenciais	Ecuacións diferenciais ordinarias. Concepto de solución. Teoremas de existencia e unicidade para problemas de condición inicial. Métodos de resolución de ecuacións diferenciais ordinarias de primeira orde: en variables separables, reducibles a variables separables, homoxéneas, lineais e reducibles a lineais. Ecuacións diferenciais exactas. Factores integrantes. Ecuación diferencial dunha familia uniparamétrica de curvas planas. Traxectorias ortogonales. Ecuacións diferenciais lineais de orde 2. Problemas de condición inicial. Conxuntos fundamentais. Método de variación de parámetros. Método de coeficientes indeterminados. Redución de orde. Ecuación de Euler. Sistemas de ecuacións diferenciais lineais de orde 1.
Métodos numéricos para problemas de valor inicial	Introdución aos métodos numéricos. Métodos de Euler e Euler mellorado. Método de Runge-Kutta de orde 4.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32	60	92
Resolución de problemas	22	24	46
Prácticas de laboratorio	6	0	6
Exame de preguntas de desenvolvemento	3	0	3
Traballo	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	O profesor exporá nas clases teóricas os contidos da materia. Os alumnos terán textos básicos de referencia para o seguimento da materia.
Resolución de problemas	O profesor resolverá problemas e exercicios e o alumno terá que resolver exercicios similares para adquirir as capacidades necesarias.
Prácticas de laboratorio	Empregaranse ferramentas informáticas para resolver exercicios e aplicar os coñecementos adquiridos.

Atención personalizada

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

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas	Realizaranse dous parciais (P1 e P2). O peso de cada un deles suporá o 25% da avaliación continua.	50	B3 B4	C1	D1 D2 D3 D6 D9 D15 D16
Exame de preguntas de desenvolvemento	Realizarase un exame final (EF) sobre os contidos de toda a materia. O peso deste exame será dun 40% para o alumnado que opte por avaliación continua e do 100% para quen non se acolla a esta.	40	B3 B4	C1	D1 D2 D3 D6 D9 D15 D16
Traballo	En cada grupo proporanse diversos exercicios ou tarefas adicionais (EJC) que terán un peso conxunto dun 10% da nota de avaliación continua.	10	B3 B4	C1	D1 D2 D6 D16

Other comments on the Evaluation

A nota de avaliación continua obterase sumando as notas P1, P2, EF e EJC ponderadas según o seu peso. Isto é, se cada proba P1, P2, EF e EJC está puntuada sobre 10, entón

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

A nota final do alumnado na primeira edición da acta calcularase como o máximo entre a nota obtida mediante avaliación continua e a nota do exame final:

NOTA FINAL = MAX{NOTA EC, EF}.

En consecuencia, a nota do alumnado que non se acolla a avaliación continua será a do exame final.
Quen non se presente ao exame final da materia obterá a calificación de NON PRESENTADO.

A avaliación na segunda oportunidade consistirá nun único exame sobre os contidos da materia que supoñerá o 100% da nota.

Compromiso ético:

Espérase que o alumnado presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (por exemplo, copia, plaxio, utilización de aparellos electrónicos non autorizados) considerarase que non reune os requisitos necesarios para superar a materia. Neste caso, a calificación global da materia no presente curso académico será de suspenso con calificación numérica de 0.

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

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

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

García, A., García, F., López, A., Rodríguez, G., de la Villa, A., **Ecuaciones Diferenciales Ordinarias**, CLAGSA, 2006
Kincaid, D., Cheney, W., **Métodos numéricos y computación**, 6ª edición, Cengage Learning, 2011

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

IDENTIFYING DATA				
Chemistry: Chemistry				
Subject	Chemistry: Chemistry			
Code	V12G350V01205			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
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 Problems resolution.
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		
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 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 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

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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,
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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,
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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				
Termodinámica e transmisión de calor				
Subject	Termodinámica e transmisión de calor			
Code	V12G350V01301			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Morán González, Jorge Carlos Santos Navarro, José Manuel			
Lecturers	Morán González, Jorge Carlos			
E-mail	jmoran@uvigo.es josanna@uvigo.gal			
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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química 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 necesaria no exercicio da profesión de Enxeñeiro Técnico Industrial. CG11 Conocimiento, comprensión y capacidad para aplicar la legislación necesaria en el ejercicio de la
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 para 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 D10 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 considerararanse 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 Y.A., y Ghajar A.J., **Transferencia de Calor y Masa. fundamentos y aplicaciones**, 4ª edición, McGraw-Hill, 2011
Çengel Yunus A., Boles Michael A., **Thermodynamics : an engineering approach**, 7th ed, McGraw-Hill, 2011
Çengel, Yunus A., **Heat and mass transfer: a practical approach**, 4th ed, McGraw-Hill, 2011
Complementary Bibliography
Wark, K. y Richards, D.E., **Termodinámica**, McGraw-Hill, 2010
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
Kreith J. y Bohn M.S, **Principios de Transferencia de Calor**, 2001,
Mills A.F., **Transferencia de calor**, 1995
Çengel Y.A., **Introduction to Thermodynamics and Heat Transfer**, McGraw-Hill, 2008
Incropera F.P. y DeWitt D.P, **Introduction to Heat Transfer**, 2002

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				
Fundamentos de electrotecnia				
Subject	Fundamentos de electrotecnia			
Code	V12G350V01302			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Enxeñaría eléctrica			
Coordinator	Albo López, María Elena Novo Ramos, Bernardino			
Lecturers	Novo Ramos, Bernardino			
E-mail	ealbo@uvigo.gal bnovo@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Os obxectivos que se perseguen con esta materia son: - Adquisición dos coñecementos referidos a símbolos, magnitudes, principios, elementos básicos e leis da electricidade. - Coñecemento de técnicas e métodos de análises de circuítos con excitación continua e en réxime *estacionario *senoidal - Descrición de sistemas *trifásicos. - Coñecemento dos principios de funcionamento e características das distintas 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.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D10	CT10 Aprendizaxe e traballo autónomos.
D14	CT14 Creatividade.
D16	CT16 Razoamento crítico.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Comprender os aspectos básicos do funcionamento dos circuítos e as máquinas eléctricas.	B3	C10	
Coñecer o proceso experimental utilizado cando se traballa con circuítos eléctricos e máquinas eléctricas			D1 D2
Coñecer as técnicas actuais dispoñibles para a análise de circuítos eléctricos		C10	D6
Coñecer as técnicas de medida de circuítos eléctricos			D6 D10
Adquirir habilidades sobre o proceso de análise de circuítos eléctricos			D1 D2 D10 D14 D16 D17

Contidos	
Topic	
INTRODUCIÓN.	Carga, corrente, potencial eléctrico, enerxía e potencia eléctrica, lei de Ohm, lei de Joule, leis de Kirchoff. Elementos Ideais. Asociación serie, paralelo de elementos ideais
ELEMENTOS REAIS.	Elementos Pasivos Reais (Resistencia, Bobina, Condensador)
RÉXIME ESTACIONARIO SENOIDAL (RES)	Formas de onda e parámetros asociados, fasores, impedancias/admitancias. Asociación de impedancias/admitancias. Comportamento dos elementos no R.E.S

FONTES E TEOREMAS FUNDAMENTAIS.	Modelos de Fontes Reais. Conversión de Fontes Reais. Teoremas Fundamentais: Linealidad, Substitución, Superposición, Thévenin e Norton.
MÉTODOS SISTEMÁTICOS DE ANÁLISE.	Nós e mallas
POTENCIA E ENERXÍA EN R.E.S	Potencias: complexa, activa, reactiva, aparente. Teorema de Boucherot. Factor de Potencia. Compensación de Potencia Reactiva
SISTEMAS TRIFÁSICOS EQUILIBRADOS	Valores de liña e fase. Reducción a monofásico equivalente. Potencia. Medida de Potencia Activa e Reactiva
TRANSFORMADORES MONOFÁSICOS E TRIFÁSICOS.	Constitución, circuíto equivalente, índice horario.
MÁQUINAS ASÍNCRONAS	Constitución. Xeración do campo giratorio. Circuito Equivalente. Curvas Características. Manobras
MAQUINAS DE ALTERNA MONOFÁSICAS	Constitución. Principio de funcionamento. Aplicacións.
MAQUINAS SÍNCRONAS.	Constitución. Funcionamento en baleiro e en carga. Sincronización.
MÁQUINAS DE CORRENTE CONTINUA.	Constitución. Circuítos Equivalentes. Curvas características
PRÁCTICAS	INTRODUCIÓN E SEGURIDADE 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. 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. BLOQUE TEORÍA DE CIRCUÍTOS 3. Asociacións de elementos. Equivalencia estrela-triángulo. 4. Elementos Reais: resistencia, bobina núcleo aire, bobina núcleo ferro, condensador, transformador. 5. Circuíto RLC serie e paralelo. Media de tensións, intensidades, potencias. Determinación de Impedancia/Admitancia Equivalente. 6. Compensación de Reactiva en Circuítos RL serie e paralelo. 7. Sistema trifásico equilibrado. Concepto de valores de liña e fase. Medida de Potencias en cargas trifásicas. BLOQUE MÁQUINAS ELÉCTRICAS 8. Ensaios no motor asíncrono trifásico Determinación do circuíto equivalente. Arranque motor asíncrono. Aplicación de REBT e introducción a Normativa de Seguridade en Máquinas (Reglamento 2023/1230 Parlamento Europeo, BOE 29/06/2023, etc...) 9. Máquinas de corrente continua. Constitución e principio de funcionamento. Aplicacións

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	19	38	57
Resolución de problemas	10.5	10.5	21
Prácticas de laboratorio	18	9	27
Resolución de problemas de forma autónoma	0	33	33
Resolución de problemas e/ou exercicios	1.5	0	1.5
Resolución de problemas e/ou exercicios	1.5	0	1.5
Informe de prácticas, prácticum e prácticas externas	0	9	9

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

Metodoloxía docente

	Description
Lección maxistral	O profesor exporá nas clases de aula os contidos da materia.
Resolución de problemas	Exporanse e resolverán problemas e exercicios tipo nas clases de aula como guía para o alumnado.
Prácticas de laboratorio	Realizaranse no laboratorio montaxes prácticas correspondentes aos contidos vistos na aula, ou ben se tratarán aspectos complementarios non tratados nas clases teóricas.
Resolución de problemas de forma autónoma	É moi aconsellable que o alumno trate de resolver pola súa conta exercicios e cuestións da materia propostos polo profesorado.

Atención personalizada	
Methodologies	**Description**
Resolución de problemas	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
Resolución de problemas e/ou exercicios	Proba EC1: Contidos de Teoría de Circuítos. Realizarase unha vez rematada a docencia do bloque de Teoría de Circuitos. Se é posible por data realizalo na semana fixada pola EEI para a primeira proba de EC, farase na data/hora fixada; de non ser posible, realizarase na última semana de novembro. Entrará todo o impartido en aula/laboratorios até a data. Valoración 40% Nota Final. Nota mínima de 3 sobre 10 para poder aprobar a materia.	40	B3 C10 D1 D2 D6 D10 D14 D16
Resolución de problemas e/ou exercicios	Proba EC2: Contidos de Máquinas Eléctricas. Realizarase o día do exame final da 1ª Convocatoria, fixado pola EEI. Valoración 40% Nota Final. Nota mínima de 3 sobre 10 para poder aprobar a materia.	40	B3 C10 D1 D6 D10 D14 D16 D17
Informe de prácticas, prácticum e prácticas externas	Valorarase a realización das prácticas e a resolución dun cuestionario en MooVI referido á montaxe, resultados obtidos e interpretación dos mesmos. Devandito cuestionario abrirase unha vez todos os grupos de prácticas realicen a práctica no laboratorio, e permanecerá aberto unha semana. A non asistencia á práctica leva asociada a cualificación de cero puntos na práctica, independentemente que o estudante entregue o correspondente cuestionario/informe. NotaPrácticas obterase como media arimética das notas obtidas en cada unha das prácticas. Dadas as características das prácticas da materia, e por esixencia do APRL da UVigo, a práctica nº 1 de Seguridade Eléctrica no Laboratorio é de realización obrigatoria, na que os estudantes deberán obter polo menos 5 puntos sobre 10 para poder realizar o resto das prácticas da materia. En caso de non cumprirse o anterior, a NotaPrácticas será de 0 puntos.	20	B3 C10 D1 D2 D6 D10 D14 D16 D17

Other comments on the Evaluation

AVALIACIÓN CONTINUA (EC):

Consta de tres partes PruebaEC1 (40% nota final), PruebaEC2 (40% nota final) e Prácticas (20% nota final), cos requisitos e especificaciós vistos no apartado anterior. A nota numérica final obtense pola media ponderada dos ítems mencionados en parágrafos anteriores:

Nota FINAL da materia= 0,4*NotaPruebaEC1 + 0,4*NotaPruebaEC2+ 0,2*NotaPrácticas
estando NotaPruebaEC1, NotaPruebaEC2 e NotaPrácticas avaliadas cada unha sobre 10 puntos.

Si como resultado da aplicación da media ponderada anterior, a nota final é superior a 4,5 puntos pero non se cumpre a condición de alcanzar un mínimo de 3 puntos en cada parte das probas de EC1 e/ou EC2, a Nota Final da materia será como máximo 4,5 puntos (suspenso).

AVALIACIÓN GLOBAL (EG) 1ª e 2ª Convocatorias:
O estudante que desexe renunciar ás actividades correspondentes á avaliación continua dispón de prazos para facelo fixados pola dirección do centro. Só poderán optar á EG, os estudantes que figuren nas listas oficiais publicadas pola dirección do Centro.
En cada convocatoria, os estudantes que renuncien á EC poderán presentarse a un exame na data oficial que cubrirá o 100% da avaliación:

- Contenidos de Teoría de Circuitos.

- Contenidos de Máquinas Eléctricas.
- Contenidos de Prácticas.

Non se gardan partes aprobadas entre convocatorias.

ESTUDANTES QUE NON RENUNCIARON A EC, con Nota Final Materia suspensa por EC (1ª e 2ª Convocatoria)
Aqueles estudantes que NON renuncien á EC, que teñan unha Nota Final Materia inferior a 5 puntos por EC, poderán presentarse a recuperación o día da proba de Avaliación Global:

- Na 1ª Convocatoria recuperación da EC1 suspensa (NotaParteTdC)
- Na 2ª Convocatoria recuperación de EC1 e/ou EC2 suspensas. (NotaParteTdC e/ou NotaParteME)

Neste caso, o cálculo da nota final da materia realizarase coa mesma expresión que para EG, substituíndo as notas obtidas nas probas de recuperación ás que se presenten, NotaParteTdC e/ou NotaParteME, polas notas suspensas en PruebaEC1 e/ou PruebaEC2. As prácticas non poden recuperarse.

Nota FINAL da materia= 0,4*NotaParteTdC (ou *NotaPruebaEC1) + 0,4*NotaParteME (ou *NotaPruebaEC2) + 0,2*NotaPrácticas

Estando cada unha das notas avaliadas sobre 10 puntos.

Si como resultado da aplicación da media ponderada anterior, a nota final é superior a 4,5 puntos pero non se cumpre a condición de alcanzar un mínimo de 3 puntos sobre 10 en cada unha das partes, NotaParteTdC (ou NotaPruebaEC1) e NotaParteME (ou NotaPruebaEC2), a Nota Final da materia será como máximo 4,5 puntos sobre 10, SUSPENSO.

Cada **NOVA MATRÍCULA** na materia supón unha posta a cero das cualificacións nas actividades de avaliación continua obtida en cursos anteriores, coa seguinte excepción: as prácticas, que se recoñecerán unicamente no curso seguinte de habelas realizado, si o estudante solicítao e cumpre estas tres condiciones:
 O estudante realizou efectivamente as prácticas no laboratorio no curso anterior (non exame de prácticas nin recoñecidas de cursos anteriores)
 O estudante obtivo unha nota de prácticas de polo menos 5 puntos sobre 10, no curso anterior.
 O estudante obtivo unha nota final da materia de polo menos 3 puntos sobre 10 no curso anterior.

Esta nota de prácticas só se recoñecerá un curso. En cursos posteriores será necesario repetir as prácticas.

COMPROMISO ÉTICO: Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, por exemplo) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Dependendo do tipo de comportamento non ético detectado, poderíase concluír que o alumno non alcanzou as competencias B2, B3 e CT19.

Bibliografía. Fontes de información

Basic Bibliography

Suárez J., Albo E., Miranda B.N., Míguez E., Albo A.B., **Apuntes F.Electrotecnia**,

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

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

jesús Fraile Mora, **Electrotecnia para ingenieros.**, 2023,

Complementary Bibliography

Suárez Creo J. y Albo López E., **Manual de Prácticas de Laboratorio de F. Electrotecnia**,

Míguez E. y Vilachá C., **Manual de Prácticas de Laboratorio Informático F. Electrotecnia**,

Jesús Fraile Mora, **Problemas de Circuitos Eléctricos**, 2019,

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

Gómez Expósito, Martínez Ramos y otros, **FUNDAMENTOS DE TEORÍA DE CIRCUITOS**, 2007,

Jesús Fraile Mora, **Máquinas eléctricas**, 2016,

Jesús Fraile Mora, **Problemas de máquinas eléctricas**, 2015,

Recomendacións

Subjects that it is recommended to have taken before

Física: Física II/V12G340V01202

Informática: Informática para a enxeñaría/V12G340V01203
Matemáticas: Álxebra e estatística/V12G340V01103

Other comments

É moi recomendable que os alumnos teñan coñecementos suficientes da álxebra dos números complexos, 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, primeiro bloque didáctico de Fundamentos de Electrotecnia. É por tanto recomendable, para o correcto seguimento da materia, ter aprobada Física II.
 Por outra banda, todo o cálculo en R.E.S., que abarca o 80% do curso, 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.

 por último, o estudante precisa coñecementos básicos de ofimática para poder cubrir os cuestionarios de prácticas en MooVI.

Por todo iso, é conveniente superar as materias dos cursos inferiores ao curso en qu está situado esta materia, especialmente Matemáticas. álxebra, Física II, antes de matricularse de Fundamentos de Electrotecnia.

IDENTIFYING DATA				
Teoría de máquinas e mecanismos				
Subject	Teoría de máquinas e mecanismos			
Code	V12G350V01303			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán Galego Inglés			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Izquierdo Belmonte, Pablo			
Lecturers	Fernández Álvarez, José Manuel Izquierdo Belmonte, Pablo			
E-mail	pabloizquierdob@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Esta materia proporcionará ao alumno coñecementos dos fundamentos básicos da Teoría de Máquinas e Mecanismos e a súa aplicación no campo da enxeñaría Mecánica. Achegaralle coñecementos sobre os conceptos máis importantes relacionados coa teoría máquinas e mecanismos. Coñecerá e aplicará as técnicas de análises *cinemático e dinámico para sistemas mecánicos, tanto gráficas e analítica, como mediante a utilización eficaz de software de simulación. Así mesmo servirá de introdución a aspectos sobre maquinaria que abordará en materias de cursos posteriores da Titulación.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C13	CE13 Coñecemento dos principios de teoría de máquinas e mecanismos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D16	CT16 Razoamento crítico.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
□ Coñecer os fundamentos básicos da Teoría de Máquinas e Mecanismos e a súa aplicación na Enxeñaría Mecánica para resolver os problemas relacionados coa devandita materia no campo da Enxeñaría Industrial. □ Coñecer, comprender, aplicar e practicar os conceptos relacionados coa Teoría de Máquina e Mecanismos □ Coñecer e aplicar as técnicas análises *cinemático e dinámico de sistemas mecánicos. □ Coñecer e utilizar eficazmente software de análise de mecanismos.	B3 B4	C13	D2 D6 D9 D10 D16

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

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

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	23	19.5	42.5
Resolución de problemas	12.5	30	42.5
Prácticas de laboratorio	18	47	65

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

Metodoloxía docente

	Description
Lección maxistral	Clase maxistral na que se expoñen os contidos teóricos.
Resolución de problemas	Resolución de problemas utilizando os conceptos teóricos presentados en aula.
Prácticas de laboratorio	Realización de tarefas prácticas en laboratorio docente ou aula informática

Atención personalizada

Methodologies	Description
Lección maxistral	Realizaranse titorías de grupo ou individuais en horario de titorías, que servirán para reforzar coñecementos adquiridos e para tutelar traballos propostos
Resolución de problemas	Realizaranse titorías de grupo ou individuais en horario de titorías, que servirán para reforzar coñecementos adquiridos e para tutelar traballos propostos
Prácticas de laboratorio	Realizaranse titorías de grupo ou individuais en horario de titorías, que servirán para reforzar coñecementos adquiridos e para tutelar traballos propostos

Avaliación

	Description	Qualification	Training and Learning Results
Resolución de problemas	Realizaranse probas de resolución de problemas no horario lectivo aprobado pola Escola. Ningunha das probas poderá superar o tanto por cento máximo establecido legalmente. Poderanse establecer cualificacións mínimas en calquera das probas para acceder á ponderación xeral. Os contidos, as datas, as ponderacións e outros detalles específicos de cada proba publicaranse a través da plataforma de teledocencia cunha antelación mínima adecuada, nunca inferior a dúas semanas antes da súa realización. Resultados de aprendizaxe: Avalíanse todos.	80	B3 C13 D2 B4 D6 D9 D10 D16
Prácticas de laboratorio	A asistencia con aproveitamento ao Laboratorio/Aula informática, a cualificación das memorias entregadas en cada práctica e os traballos tutelados, terán unha valoración máxima de 2 puntos da nota final. Para poder ser avaliado neste apartado o alumno deberá asistir a un número mínimo de prácticas. Resultados de aprendizaxe: Avalíanse todos.	20	B3 C13 D2 B4 D6 D9 D10 D16

Other comments on the Evaluation

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

Probas de resolución de problemas. Realizaranse probas de resolución de problemas no horario lectivo aprobado pola Escola. Ningunha das probas poderá superar o tanto por cento máximo establecido legalmente. Poderanse establecer cualificacións mínimas en calquera das probas para acceder á ponderación xeral. Os contidos, as datas, as ponderacións e outros detalles específicos de cada proba publicaranse a través da plataforma de teledocencia cunha antelación mínima adecuada, nunca inferior a dúas semanas antes da súa realización.

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

* Empregarase 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).

Avaliación global. Para o alumnado que renuncie expresamente á avaliación continua realizarase un único exame no que se poderán avaliar todos os contidos da materia, puntuado sobre 10 puntos.

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

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

Complementary Bibliography

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

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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,

Recomendacións

Subjects that continue the syllabus

Deseño de máquinas I/V12G380V01304
Automóbiles e ferrocarrís/V12G380V01941
Deseño de máquinas hidráulicas e sistemas oleopneumáticos/V12G380V01914
Deseño de máquinas II/V12G380V01911
Deseño mecánico asistido/V12G380V01915
Enxeñaría do transporte/V12G380V01945
Motores e máquinas térmicos/V12G380V01913
Sistema de análise, simulación e validación de datos/V12G380V01933
Vehículos automóbiles híbridos e eléctricos/V12G380V01944

Subjects that it is recommended to have taken before

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

Other comments

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

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

IDENTIFYING DATA				
Fundamentos de sistemas e tecnoloxías de fabricación				
Subject	Fundamentos de sistemas e tecnoloxías de fabricación			
Code	V12G350V01304			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán			
Department	Deseño na enxeñaría			
Coordinator	Diéguez Quintas, José Luís			
Lecturers	Diéguez Quintas, José Luís Fernández Ulloa, Antonio			
E-mail	jdieguez@uvigo.es			
Web	http://moovi.uvigo.es			
General description	Os obxectivos docentes de Fundamentos de Sistemas e Tecnoloxías de Fabricación, nos seus aspectos fundamentais e descritivos, céntranse no estudo e a aplicación de coñecementos científicos e técnicos relacionados cos procesos de fabricación de compoñentes e conxuntos cuxa finalidade funcional é mecánica, así como a avaliación da súa precisión *dimensional e a dos produtos a obter, cunha calidade determinada. Todo iso incluíndo desde as fases de preparación até as de utilización dos instrumentos, as ferramentas, *utillajes, equipos, máquinas ferramenta e sistemas necesarios para a súa realización, de acordo coas normas e *especificaciones establecidas, e aplicando criterios de optimización. Para alcanzar os obxectivos mencionados impartirase a seguinte temática docente: - Fundamentos de *metrología *dimensional. Medida de lonxitude, ángulos, formas e elementos de máquinas. - Estudo, análise e avaliación das tolerancias *dimensionales. - Procesos de conformado de materiais mediante arranque de material, operacións, *maquinas, equipos e *utillaje. - Procesos de conformado mediante deformación plástica, operacións, máquinas, equipos e *utillaje. - Procesos de conformado por moldeo, operacións, máquinas, equipos e *utillaje. - Procesos de conformado non convencionais, operacións, máquinas, equipos e *utillaje. - Conformado de *polímeros, e outros materiais non metálicos, operacións, máquinas, equipos e *utillaje. - Procesos de unión e *ensamblaje, operacións, máquinas, equipos e *utillaje. - Fundamentos da programación de máquinas con *CNC, utilizadas na fabricación mecánica.			

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.
C15	CE15 Coñecementos básicos dos sistemas de produción e fabricación.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral e escrita de coñecementos.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D16	CT16 Razoamento crítico.
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	
Coñecer a base tecnolóxica e aspectos básicos dos procesos de fabricación	C15	D2 D3 D9 D10 D16 D20

Comprender os aspectos básicos dos sistemas de fabricación	B3	C15	D2 D10
Adquirir habilidades para a selección de procesos de fabricación e elaboración da planificación de fabricación		C15	D1 D2 D3 D8 D17
Desenvolver habilidades para a fabricación de conxuntos e elementos en contornas *CAD/*CAM	B3	C15	D2 D8 D9 D16 D17 D20

Contidos	
Topic	
UNIDADE DIDÁCTICA 1. INTRODUCIÓN Ás TECNOLOXÍAS E SISTEMAS DE FABRICACIÓN.	Lección 1. INTRODUCIÓN Á ENXEÑARÍA DE *FABRICACION. O ciclo produtivo. Clasificación de industrias. Tecnoloxías de fabricación.
UNIDADE DIDÁCTICA 2. *METROTECNIA.	Lección 2. PRINCIPIOS DE *METROLOGÍA *DIMENSIONAL. Introdución. Definicións e conceptos. O Sistema Internacional de Unidades. Magnitudes físicas que abarca a *Metrología *Dimensional. Elementos que interveñen na medición. Clasificacións dos métodos de medida. Patróns. A cadea de *trazabilidad. *Calibración. Incerteza. Cadea de *calibración e transmisión da incerteza. Relación entre tolerancia e incerteza. Expresión da incerteza de medida en *calibración. Lección 3. INSTRUMENTOS E MÉTODOS DE MEDIDA. Introdución. Patróns. Instrumentos de verificación. Patróns *interferométricos. Principios de *interferometría. Instrumentos de medida directa. Métodos e instrumentos de medida indirecta. Lección 4. MEDICIÓN POR COORDENADAS. MEDICIÓN POR IMAXE. CALIDADE SUPERFICIAL. Máquinas de medición por coordenadas. Concepto. Principios das *MMC. Clasificación das máquinas. Principais compoñentes das *MMC. Proceso a seguir para o desenvolvemento dunha medida. Sistemas de medición por imaxe. Calidade Superficial. Métodos de medida da rugosidade. Parámetros de rugosidade.

UNIDADE DIDÁCTICA 3. PROCESOS DE CONFORMADO POR ARRANQUE DE MATERIAL	Lección 5. INTRODUCIÓN Ao CONFORMADO POR ARRANQUE DE MATERIAL. Introdución. Movementos no proceso de arranque de material. Factores a ter en conta na elección da ferramenta. Xeometría de ferramenta. Materiais de ferramenta. Mecanismo de formación da labra. Tipos de labras. Potencia e forzas de corte. Desgaste de ferramenta. Criterios de desgaste de ferramenta. Determinación da vida da ferramenta. Fluídos de corte. Lección 6. *TORNEADO: OPERACIÓNS, *MAQUINAS E *UTILLAJE. Introdución. Principais operacións en torno. A máquina-ferramenta: o torno. Partes principais do torno. Montaxe ou *sujeción de pezas. Ferramentas típicas do torno. *Tornos especiais. Lección 7. *FRESADO: OPERACIÓNS, MÁQUINAS E *UTILLAJE. Introdución. Descrición e clasificación das operacións de *fresado. Partes e tipos principais de *fresadoras. Tipos de fresas. Montaxe da ferramenta. *Sujeción de pezas. Diferentes configuracións de *fresadoras. *Fresadoras especiais. Lección 8. MECANIZADO DE BURACOS E CON MOVEMENTO PRINCIPAL *RECTILÍNEO: OPERACIÓNS, MÁQUINAS E *UTILLAJE. Introdución ás operacións de mecanizado de buracos. *Taladradoras. *Mandrinadoras. Características xerais dos procesos de mecanizado con movemento principal *rectilíneo. *Limadora. *Mortajadora. *Cepilladora. *Brochadora. Serras. Lección 9. CONFORMADO CON *ABRASIVOS: OPERACIÓNS, MÁQUINAS E *UTILLAJE. Introdución ás operacións de mecanizado de buracos. Muelas *abrasivas. Operación de rectificado. Tipos de *rectificadoras. *Honeado. *Lapeado. Pulido. *Bruñido. *Superacabado Lección 10. PROCESOS DE MECANIZADO NON CONVENCIONAIS. Introdución. O mecanizado por *electroerosión ou *electro-descarga. Mecanizado *electroquímico. Mecanizado por láser. Mecanizado por chorro de auga. Corte por arco de plasma. Mecanizado por ultrasóns. *Fresado químico.
UNIDADE DIDÁCTICA 4. AUTOMATIZACIÓN E XESTIÓN DOS PROCESOS DE FABRICACIÓN.	Lección 11. CONTROL NUMÉRICO DE MÁQUINAS FERRAMENTA. Introdución. Vantaxes da aplicación do *CN nas máquinas ferramenta. Información necesaria para a creación dun programa de *CN. Programación manual de *MHCN. Tipos de linguaxe de *CN. Estrutura dun programa en código *ISO. Caracteres empregados. Funcións preparatorias (*G__). Funcións auxiliares (*M__). Interpretación das principais funcións. Exemplos. Programación automática en control numérico.

UNIDADE DIDÁCTICA 5. PROCESOS DE CONFORMADO DE MATERIAIS EN ESTADO LÍQUIDO E *GRANULAR.	Lección 12. ASPECTOS XERAIS DO CONFORMADO POR *FUNDICIÓN DE METAIS. Introdución. Etapas no conformado por *fundición. Nomenclatura das principais partes do *molde. Materiais empregados no conformado por *fundición. Fluxo do fluído no sistema de alimentación. *Solidificación dos metais. Contracción dos metais. O *rechupe. Procedemento de cálculo do sistema distribución de coada. Consideracións sobre deseño e defectos en pezas fundidas. Lección 13. PROCESOS DE FABRICACIÓN POR *FUNDICIÓN. Clasificación dos procesos de *fundición. Moldeo en area. Moldeo en casca. Moldeo en *yeso. Moldeo en cerámica. Moldeo ao CO2. Moldeo á cera perdida *Fundición en *molde cheo. Moldeo *Mercast. Moldeo en *molde permanente. *Fundición inxectada. *Fundición *centrifugada. Fornos empregados en *fundición. Lección 14. *METALURGIA DE POS (*PULVIMETALURGIA). Introdución. Fabricación dos pos metálicos. Características e propiedades dos pos metálicos. *Dosificación e mestura de pos metálicos. *Compactación. *Sinterizado. Fornos de *sinterización. *Sinterizado por descarga *disruptiva. *Presinterizado. Operacións posteriores. Consideracións de deseño. Produtos *obtenibles por *sinterización. Lección 15. CONFORMADO DE PLÁSTICOS. Introdución. Clasificación materiais *poliméricos. Propiedades físicas de *polímeros. Clasificación dos procesos. Moldeo por *extrusión. Moldeo por inxección. Moldeo por *compresión. Moldeo por transferencia. Moldeo *rotacional. *Termoconformado.
UNIDADE DIDÁCTICA 6. PROCESOS DE CONFORMADO POR UNIÓN.	Lección 16. PROCESOS DE SOLDADURA. Introdución aos procesos de soldadura. Soldadura con arco eléctrico. Soldadura por resistencia. Soldadura con osíxeno e gas combustible .Soldadura con temperatura de fusión de metal de achegue menor que a dos metais a unir. Lección 17. PROCESOS DE UNIÓN E MONTAXE SEN SOLDADURA. Procesos de unión mediante adhesivos. Resistencia á adhesión. Condicións para o pegado. Deseño de unións Tipos de adhesivos segundo orixe e composición. Procesos de unión mecánica. Unións mecánicas *desmontables e permanentes.
UNIDADE DIDÁCTICA 7. PROCESOS DE CONFORMADO POR DEFORMACIÓN PLÁSTICA DE METAIS.	Lección 18. ASPECTOS XERAIS DO CONFORMADO POR DEFORMACIÓN PLÁSTICA. Introdución. Curvas de esforzo-deformación. Expresións da deformación. Constancia do volume. Modelos aproximados da curva esforzo real-deformación natural. Estado de deformación plana. Procesos primarios e secundarios. Procesos de traballo en quente e en frío. Condicións e control do proceso. Lección 19. PROCESOS DE *LAMINACIÓN E FORXA. *Laminación: fundamentos; temperatura de *laminación; equipos para a *laminación en quente; características, calidade e tolerancias dos produtos *laminados en quente; *laminación en frío. Forxa: libre; en matriz de impresión; en prensa; por recalcado; *encabezamiento en frío; por *laminación; en frío. Lección 20. *EXTRUSIÓN, *EMBUTICIÓN E AFÍNS. *Extrusión. Estirado de barras e tubos. *Trefilado. Redución de sección. *Embutición. *Repujado en torno. Pezas realizables por *repujado: consideracións de deseño. Conformación por estirado. Conformación con *almohadillas de caucho e con líquido a presión. Conformación a gran potencia. Lección 21. CONFORMADO DE CHAPA METÁLICA. *Curvado ou dobrado de chapas. *Curvado con rodetes. Conformado con rodetes. Endereitado. *Engatillado. Operacións de corte de chapa.

PROGRAMA DE PRÁCTICAS	Práctica 1.- Utilización dos aparellos convencionais de *metrología. Medición de pezas utilizando pé de rei normal, de profundidades, *micrómetro de exteriores e interiores. Emprego de reloxo *comparador. Comprobación de superficies planas. Uso de calibres pasa/non pasa, regras, escuadras e calas patrón. Medición e comprobación de roscas. Realización de medicións *métricas e en unidades inglesas. Práctica 2.-Medicións indirectas. Comprobación dun cono utilizando rodetes e un pé de rei, medición dunha cola de *milano utilizando rodetes, medición dos ángulos dunha dobre cola de *milano e medicións utilizando unha regra de seos. Medicións directas con *goniómetro. Comprobación de roscas. Práctica 3.- Máquina de medición por coordenadas. Selección sistema de coordenadas. Comprobación de medidas en peza, utilizando unha máquina de medir por coordenadas. Verificación de tolerancias, forma e posición. Práctica 4.- Fabricación con máquinas ferramentas convencionais. Fabricación dunha peza empregando o torno, a *fresadora e o trade convencionais, definindo as operacións básicas e realizándoas sobre a máquina. Planificación de procesos de fabricación. Realización de follas de procesos. Práctica 5, 6 e 7.- Iniciación ao control numérico aplicado ao torno e á *fresadora. Realización dun programa en *CNC utilizando un simulador, coas ordes principais e máis sinxelas. Programación e mecanizado de pezas tanto no torno como na *fresadora da aula taller. Práctica 8.- Soldadura. Coñecemento de diferentes equipos de soldadura eléctrica. *Soldeo de diferentes materiais empregado as técnicas de *electrodo revestido, *TIG e *MIG. Practica 9.- Proba práctica puntuable sobre control numérico.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	0	32.5
Prácticas de laboratorio	18	0	18
Exame de preguntas obxectivas	1	0	1
Exame de preguntas obxectivas	1	0	1
Práctica de laboratorio	2	0	2
Estudo de casos	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	As clases teóricas realizaranse combinando as explicacións de lousa co emprego de vídeos e presentacións de computador. A finalidade destas é complementar o contido dos apuntamentos, interpretando os conceptos nestes expostos mediante a mostra de exemplos e a realización de exercicios.
Prácticas de laboratorio	As clases prácticas de laboratorio realizaranse en 9 sesións de 2 horas, salvo os alumnos do curso ponte que realizarán as prácticas nas 6 sesións que contempla o seu horario particular, en grupos de 20 alumnos máximo, e empregando os recursos dispoñibles de instrumentos e máquinas, combinándose coas simulacións por computador.

Atención personalizada

Methodologies	Description
Lección maxistral	Clases de teoría en aula
Prácticas de laboratorio	Prácticas de laboratorio por grupos

Avaliación

	Description	Qualification	Training and Learning Results
Exame de preguntas obxectivas	EX1 (proba avaliación continua - 36% nota final-) Proba escrita e presencial a realizar a metade de curso sobre os contidos desde o inicio até ese momento. Carácter obrigatorio. Estará composta por 12 preguntas tipo test sobre os contidos teórico/prácticos da materia. A nota deste test obterase sumando 0,3 puntos por cada cuestión correctamente contestada e restaranse 0,1 puntos si a cuestión é resolta de forma incorrecta. As cuestións en branco non puntúan, pero só se poden deixar 4 preguntas en branco.	36	B3 C15 D8 D9 D10
Exame de preguntas obxectivas	EX2 (proba avaliación continua - 39% nota final-) Proba escrita e presencial a realizar a final de curso sobre os contidos desde metade de curso até o final. Carácter obrigatorio. Estará composta por 13 preguntas tipo test sobre os contidos teórico/prácticos da materia. A nota deste test obterase sumando 0,3 puntos por cada cuestión correctamente contestada e restaranse 0,1 puntos si a cuestión é resolta de forma incorrecta. As cuestións en branco non puntúan, pero só se poden deixar 4 preguntas en branco.	39	B3 D9 D10 D17
Práctica de laboratorio	*CNC (proba avaliación continua - 15% nota final-): Unha proba a realizar no horario de clase práctica consistente na realización dun programa de control numérico que mecanice a peza que se lle presente.	15	C15 D2 D8 D9 D10 D17 D20
Estudo de casos	*MEM (proba avaliación continua - 10% nota final-): Unha proba escrita, traballo ou memoria a propor polo profesor ao longo do cuadrimestre. Esta proba valorarase cun máximo de 1 punto, o 10% da nota final.	10	C15 D2 D8 D9 D10 D17 D20

Other comments on the Evaluation

APROBADO

Alumnos cualificados mediante avaliación continua:

Para superar esta materia é necesario polo menos obter 5 puntos sumando a puntuación de próbalas tipos EX1, EX2, CNC e MEM nas condicións anteriormente expostas.

No caso de que se deixen máis de 4 preguntas en branco nas probas EX1 ou EX2 a puntuación nesa proba será 0.

Todos os alumnos en principio deberán seguir o procedemento de avaliación continua, salvo aqueles que expresamente renuncien no prazo e forma séndolles concedida a renuncia por parte da escola.

Alumnos cualificados con renuncia concedida á avaliación continua:

Para superar esta materia é necesario polo menos obter 5 puntos sumando a puntuación de próbalas tipos EXA e REC, nas condicións seguintes:

EXA (exame teórico/práctico renuncia a avaliación continua - 75% nota final-)

Proba escrita e presencial a realizar sobre a totalidade.

Estará composta por 25 preguntas tipo test sobre os contidos teórico/prácticos da totalidade da materia.

A nota deste test obterase sumando 0,3 puntos por cada cuestión correctamente contestada e restaranse 0,1 puntos se a cuestión é resolta de forma incorrecta. As cuestións en branco non puntúan, pero só se poden deixar 8 preguntas en branco.

PRA (exame práctico renuncia a avaliación continua - 25% nota final-)

Resolución por escrito de varios problemas prácticos, cuxo valor será o 25% da nota final. É necesario obter un mínimo de 1 punto nesta proba para que a cualificación póidase sumar á da proba EXA e poder obter polo menos 5 puntos para superar a materia.

Estas probas, realizarana exclusivamente os alumnos aos que se lles concedeu a renuncia á avaliación continua, e realizarase o día fixado polo centro para a avaliación de 1º oportunidade.

ASISTENCIA A CLASES TEÓRICAS E PRÁCTICAS

A asistencia a clases teóricas e prácticas non é obrigatoria, pero será sempre materia de exame o que nelas impártese.

CONVOCATORIA EXTRAORDINARIA (Acta de 2º edición / Julio)

Alumnos cualificados mediante avaliación continua:

Esta segunda edición da convocatoria ordinaria cualificarase da seguinte maneira:

- Mediante a realización da proba obrigatoria tipo EXA.

EXA (exame teórico/práctico renuncia a avaliación continua - 75% nota final-)

Proba escrita e presencial a realizar sobre a totalidade. Estará composta por 25 preguntas tipo test sobre os contidos teórico/prácticos da totalidade da materia. A nota deste test obterase sumando 0,3 puntos por cada cuestión correctamente contestada e restaranse 0,1 puntos se a cuestión é resolta de forma incorrecta. As cuestións en branco non puntúan, pero só se poden deixar 8 preguntas en branco.

- Consérvanse as cualificacións de próbalas avaliación continua CNC e MEM nesta 2ª oportunidade, pero poderase, se se desexa, mellorar esta cualificación:

CNC: mediante a realización dunha nova proba de programación de máquinas ferramenta, que será tipo test, ao finalizar a proba EXA de 2ª edición.

MEM: mediante unha nova proba escrita traballo ou memoria, que será similar, a entregar na data que se publique, antes do día da convocatoria desta segunda edición.

Para superar esta materia é necesario polo menos obter 5 puntos sumando as tres anteriores probas e cumprindo iguais mínimos que na 1ª edición.

As notas das probas de avaliación continua, non se conservará dun curso para outro.

Alumnos cualificados con renuncia concedida á avaliación continua:

Os alumnos que non realicen avaliación continua, debido a que o centro lles ha aceptado a renuncia, sempre deberán realizar en todas as convocatorias próbaa tipo EXA e próbaa tipo PRA, nos termos especificados para a primeira oportunidade.

Para superar esta materia é necesario polo menos obter 5 puntos sumando as dúas anteriores probas.

CONVOCATORIA EXTRAORDINARIA FINAL DE CARRERA:

Esta proba será igual para todos os alumnos e consistirá nunha proba tipo EXA e unha proba tipo PRA, nos termos especificados nos anteriores apartados para os alumnos con renuncia a avaliación continua.

Para superar esta materia é necesario polo menos obter 5 puntos sumando as dúas anteriores probas, cumprindo iguais mínimos que nas convocatorias ordinarias.

COMPROMISO ÉTICO:

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

Bibliografía. Fontes de información

Basic Bibliography

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**,

Recomendacións

Subjects that are recommended to be taken simultaneously

Ciencia e tecnoloxía dos materiais/V12G350V01305

Other comments

Requisitos: Para matricularse desta materia é necesario ter superado ou ben estar matriculado de todas as materias dos cursos inferiores ao curso ao que está emprazada esta materia.

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

IDENTIFYING DATA				
Materials science and technology				
Subject	Materials science and technology			
Code	V12G350V01305			
Study programme	Grado en Ingeniería en Química Industrial			
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 Cabeza Simo, Marta María Cortes Redin, María Begoña Figueroa Martínez, Raúl			
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 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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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 Apply knowledge.
D10	CT10 Self learning and work.

Expected results from this subject	Training and Learning Results		
It comprises the fundamental concepts of link, structure and microestructure of the distinct types of materials	B3	C9	D10
It comprises the relation go in to microestructure of the material in his mechanical behaviour, electrical, thermal and magnetic	B3	C9	
It comprises the mechanical behaviour of the metallic materials, ceramic, plastics and compound	B4 B6		
It knows how they can modify the properties by means of mechanical processes and thermal treatments	B4	C9	D9
It knows the basic technicians of structural characterisation of the materials	B3 B6	C9	
It purchases skills in the handle of the diagrams and charts			D1 D5
It purchases skill in the realisation of essays	B6	C9	D10
It analyses the results obtained and extracts conclusions of the same			D1 D9
It is able to apply norms of essays of materials	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

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

Complementary Bibliography

Smith, William F, **Fundamentos de la ciencia e ingeniería de materiales**, 5ª, McGraw-Hill, 2010

AENOR, **Standard tests**,

Montes J.M., Cuevas F.G., Cintas J., **Ciencia e ingeniería de los materiales / J.M. Montes, F.G. Cuevas, J. Cintas**, 1ª, Paraninfo, 2014

Recommendations

Subjects that continue the syllabus

Materials engineering/V12G380V01504

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

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

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				
Mecánica de fluídos				
Subject	Mecánica de fluídos			
Code	V12G350V01401			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Vence Fernández, Jesús			
Lecturers	Gil Pereira, Christian Vence Fernández, Jesús			
E-mail	jvence@uvigo.es			
Web				
General description	Nesta guía docente preséntase información relativa á materia Mecánica de Fluídos de 2º curso do grao en Enxeñaría en Química Industrial no que se continúa de forma coordinada un achegamento ás directrices marcadas polo Espazo Europeo de Educación Superior. Neste documento recóllense as competencias xenéricas que se pretende que os alumnos adquiran neste curso, o calendario de actividades docentes previsto e a guía docente de materia. A Mecánica de Fluídos describe os fenómenos físicos relevantes do movemento dos fluídos, describindo as ecuacións xerais de devanditos movementos , incluíndo as ecuacións de fluxos multifásicos. Este coñecemento proporciona os principios básicos necesarios para analizar calquera sistema no que o fluído sexa o medio de traballo.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C8	CE8 Coñecementos dos principios básicos da mecánica de fluídos e a súa aplicación á resolución de problemas no campo da enxeñaría. Cálculo de tubaxes, canais e sistemas de fluídos.
D2	CT2 Resolución de problemas.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Entender os principios básicos do movemento de fluídos.	B3 B4	C8	D2 D9 D10
Capacidade para calcular tubaxes, canles e calquera tipo de sistemas ou procesos onde interveña un fluído simple ou *multifásico.	B4	C8	D2 D9
Entender los principios del movimiento de un fluido.		C8	D2 D9
Aplicación da teoría do movemento de fluídos.		C8	D2 D9
Capacidade para coñecer e dominar as ferramentas físico -matemáticas coas que se abordan os problemas.			D9
Síntese do coñecemento da mecánica de fluídos para o cálculo e deseño de calquera peza cuxo medio de traballo sexa un fluído. Capacidade para manexar e deseñar medidas de magnitudes físicas .			D10

Contidos
Topic

1. INTRODUCIÓN	1.1 Conceptos fundamentais 1.1.1 Tensión de cortadura. Lei de Newton 1.2 Mesturas. Definicións básicas 1.3 Continuo 1.4 Viscosidade 1.4.1 Fluídos newtonianos e non newtonianos 1.5 Características dos fluxos 1.5.1 Clases de fluxos 1.4.1.1 Segundo condicións xeométricas 1.5.1.2 Segundo condicións cinemáticas 1.5.1.3 Segundo condicións mecánicas de contorno 1.5.1.4 Segundo a compresibilidad 1.6 Esforzos sobre un fluído 1.6.1 Magnitudes tensoriales e vectoriales 1.6.1.1 Forzas volumétricas 1.6.1.2 Forzas superficiais 1.6.1.3 O tensor de tensións. 1.6.1.4 Concepto de presión. Presión nun punto 1.6.1.5 Tensión superficial
2. FUNDAMENTOS DO MOVEMENTO DE FLUÍDOS	2.1 CAMPO DE VELOCIDADES 2.1.1 Enfoque Euleriano e enfoque Lagrangiano 2.1.2.Tensor gradiente de velocidade 2.2 LINEAS DE CORRENTE 2.3 SISTEMAS E VOLUME DE CONTROL 2.4 INTEGRAIS ESTENDIDAS A VOLUMENES FLUÍDOS 2.4.1 Teorema do transporte de Reynolds 2.5 ECUACIÓN DE CONTINUIDADE 2.5.1 Diversas expresións da ecuación de continuidade 2.5.2 Función de corrente 2.5.3 Fluxo volumétrico ou caudal 2.6 Ecuación da difusión da masa. 2.6.1 Ecuación de conservación das especies ou difusión en forma integral. 2.6.2 Ecuación de conservación das especies ou difusión en forma diferencial. 2.7 ECUACIÓN DE CONSERVACIÓN DA CANTIDADE DE MOVEMENTO 2.7.1 Forma integral. Exemplos de aplicación 2.7.2 Ecuación de conservación do momento cinético 2.7.3 Forma diferencial da E.C.C.M. 2.7.4 Ecuación de Euler 2.7.5 Ecuación de Bernouilli 2.8 LEI DE NAVIER-POISSON 2.8.1 Deformacións e esforzos nun fluído real 2.8.1.1 Relacións entre eles 2.8.1.2 Ecuación de Navier-Stokes 2.9 ECUACIÓN DA ENERXÍA 2.9.1 Forma integral 2.9.2 Forma diferencial 2.9.2.1 Ecuación da enerxía mecánica 2.9.2.2 Ecuación da enerxía interna. 2.9.3 Extensión do caso de traballos exteriores aplicados ao volume de control. Aplicación a máquinas hidráulicas

3. ANALISE DIMENSIONAL E SEMELLANZA FLUIDODINAMICA	3.1INTRODUCCION 3.3 TEOREMA PI DE BUCKINGHAN. APLICACIÓNS 3.4 GRUPOS ADIMENSIONAIS DE IMPORTANCIA NA MECÁNICA DE FLUÍDOS 3.4.1. Significado físico dos números dimensionales 3.5 SEMELLANZA 3.5.1 Semellanza parcial 3.5.2 Efecto de escala
4. MOVEMENTO LAMINAR CON VISCOSIDADE DOMINANTE	4.1 INTRODUCIÓN 4.2.MOVEMENTO LAMINAR PERMANENTE 4.2.1 Correntes de Hagen-Poiseuille 4.2.2 En condutos de sección circular 4.2.3 Outras seccións 4.3 EFECTO DE LONXITUDE FINITA DO TUBO 4.4 PERDA DE CARGA 4.4.1Coeficiente de fricción 4.5 ESTABILIDADE DE CORRENTE LAMINAR
5. MOVEMENTO TURBULENTO	5.1 INTRODUCIÓN 5.1.1 Lonxitude de Mestura de Prandtl 5.1.2 Fluxos Multifásicos en condutos 5.2 PERDA DE CARGA EN FLUXOS TURBULENTOS EN CONDUTOS 5.2.1 Diagrama de Nikuradse 5.2.2 Diagrama de Moody 5.2.3 Fórmulas empíricas para fluxo en tubaxes
6. MOVEMENTOS DE LIQUIDOS EN CONDUTOS DE SECCION VARIABLE	6.1 INTRODUCIÓN 6.2 PERDAS LOCAIS 6.2.1 Perda á entrada dun tubo 6.2.2 Perda nun tubo a saída 6.2.3 Perda por contracción 6.2.4 Perda por ensanche 6.2.5 Perda en cóbados.
7. SISTEMAS DE TUBERIAS	7.1 TUBAXES EN SERIE 7.2 TUBAXES EN PARALELO 7.3 PROBLEMA DO TRES DEPOSITOS 7.4 REDES DE TUBAXES 7.5 TRANSITORIOS EN TUBAXES. 7.5.1 Tempo de baleirado dun recipiente 7.5.2 Establecemento do réxime permanente nunha tubaxe 7.5.3 Golpe de ariete
8. FLUXO PERMANENTE EN CANLES	8.1 INTRODUCIÓN 8.2 MOVEMENTO UNIFORME 8.2.1 Condutos pechados usados como canles 8.3 MOVEMENTO NON UNIFORME 8.3.1 Resalto hidráulico 8.3.2 Transicións rápidas 8.3.3 Vertedoiro de parede grosa 8.3.4 Comporta 8.3.5 Sección de control

9. EXPERIMENTACIÓN DE FLUXOS. MEDIDORES	9. 1 MEDIDORES DE PRESION 9.1.1 Manómetro simple 9.1.2 Manómetro Bourdon. 9.1.3 Transductor de presión 9.2 MEDIDORES DE VELOCIDADE 9.2.1 Tubo de Pitot 9.2.2 Tubo de Prandt 9.2.3 Anemómetro de rotación 9.2.4 Anemómeto de fío quente 9.2.5 Anemómetro laser-dopler 9.3 MEDIDORES DE FLUXO 9.3.1 Medidores de presión diferencial: diafragma, venturi, tobera de fluxo, medidor abacelado 9.3.2 Outros tipos.
PRACTICAS DE LABORATORIO	VISCOSIDADE. FLUÍDOS NEWTONIANOS. Exercicios Aplicación práctica: VISCOSIMETROS ECUACIÓNS DE GOBERNO Exercicios Tubo de Pitot Aplicación práctica: CHORRO LIBRE. Distribución Radial de velocidades. Turbulencia en fluxos non confinados. Gasto Másico. Cantidade de Movemento ANÁLISE DIMENSIONAL E SEMELLANZA Exercicios Aplicación práctica:TUNEL DE VENTO. Distribución de presións ao redor dun cilindro. Cálculo do coeficiente de resistencia. FLUXOS EN CONDUTOS EXPERIMENTO DE REYNOLDS Transición de réxime laminar a turbulento PERDIDAS DE CARGA E MEDIDORES DE CAUDAL Exercicios Aplicacións prácticas: Medida de caudal con venturímetro. Medida de caudal con placa de orificio Coeficiente de fricción. Perdas de carga en cóbados. Perdas de carga en válvulas. TRANSITORIOS EN TUBERIA Exercicios Aplicación práctica:GOLPE DE ARIETE Golpes de presión nunha tubaxe. Modo operativo dunha cámara de equilibrio

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	60.5	93
Resolución de problemas	14	0	14
Resolución de problemas de forma autónoma	0	24	24
Prácticas de laboratorio	4	0	4
Exame de preguntas de desenvolvemento	3	0	3
Resolución de problemas e/ou exercicios	3	3	6
Resolución de problemas e/ou exercicios	3	0	3
Informe de prácticas, prácticum e prácticas externas	0	3	3

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

Metodoloxía docente

	Description

Lección maxistral	Explícanse os fundamentos de cada tema para posterior resolución de problemas prácticos. Poderanse realizar actividades como: Sesión maxistral Lecturas Revisión bibliográfica Resumen Esquemas Solución de problemas Conferencias
Resolución de problemas	Aplicaranse os conceptos desenvolvidos de cada tema á solución de exercicios.
Resolución de problemas de forma autónoma	Aplicaranse os conceptos desenvolvidos de cada tema á solución de exercicios. Inclúe actividades tales como: Lecturas Seminarios Solución de problemas Aprendizaxe colaborativo Estudo de casos práctico
Prácticas de laboratorio	Aplicaranse os conceptos desenvolvidos de cada tema á realización de prácticas de laboratorio. Fundamentalmente, realizaranse actividades de experimentación, aínda que tamén poderán realizarse: Casos prácticos Simulación Solución de problemas Aprendizaxe colaborativo

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	O profesor estará dispoñible para resolver dúbidas durante o seu horario de titorías, en modalidade presencial e/ou telemática, segundo previo acordo co alumnado.
Lección maxistral	O profesor estará dispoñible para resolver dúbidas durante o seu horario de titorías, en modalidade presencial e/ou telemática, segundo previo acordo co alumnado.
Resolución de problemas	O profesor estará dispoñible para resolver dúbidas durante o seu horario de titorías, en modalidade presencial e/ou telemática, segundo previo acordo co alumnado.
Resolución de problemas de forma autónoma	O profesor estará dispoñible para resolver dúbidas durante o seu horario de titorías, en modalidade presencial e/ou telemática, segundo previo acordo co alumnado.

Avaliación

	Description	Qualification	Training and Learning Results		
Exame de preguntas de desenvolvemento	Proba escrita que poderá constar de: cuestións teóricas, cuestións prácticas, resolución de exercicios/problemas, tema a desenvolver	40	B3 B4	C8	D2 D9 D10
Resolución de problemas e/ou exercicios	Avaliación continua teórico-práctica	25	B3 B4		D2 D9 D10
Resolución de problemas e/ou exercicios	Avaliación continua teórico-práctica	25	B3 B4		D2 D9 D10
Informe de prácticas, prácticum e prácticas externas	Informe das actividades realizadas nas sesións de laboratorio, incluíndo resultados da experimentación e interpretación dos mesmos.	10	B3 B4	C8	D2 D9 D10

Other comments on the Evaluation

Avaliación continua:

A avaliación da materia divídese nos seguintes apartados:

- **Primera proba de avaliación continua (25% da nota total da materia):** Proba consistente en cuestións teórico-prácticas, incluíndo resolución de exercicios e problemas e/ou tema a deselvolver. Podería incluir cuestionarios tipo test.

- **Segunda proba de avaliación continua (25% da nota total da materia):** Proba consistente en cuestións teórico-prácticas, incluíndo resolución de exercicios e problemas e/ou tema a deselvolver. Podería incluir cuestionarios tipo test.
- **Prácticas de laboratorio (10% da nota total da materia):** Entrega de informes/cuestionarios e/ou realización de probas orais de polo menos unha práctica experimental/TIC a realizar durante o curso.
- **Primera final de avaliación continua (40% da nota total da materia):** Proba consistente en cuestións teórico-prácticas, incluíndo resolución de exercicios e problemas e/ou tema a deselvolver. Podería incluir cuestionarios tipo test.

A nota final da materia calcularase coa seguinte fórmula:**Nota final = máximo {0.6 NC + 0.4 NF , NF + (1/30)NC(10 - NF)}**donde NC é a nota media ponderada das duas probas de avaliación continua e das prácticas de laboratorio (no rango de 0 a 10) e NF é a nota da proba final (no rango de 0 a 10).

Avaliación Global:

Realizarase un único exame final na data oficial fixada pola Escola (100% da nota total da materia).

Por defecto, a avaliaicón será na modalidade de Avaliación Continua para todo o alumnado. Poderá renunciar a esta modalidade de avaliación todo aquel que o desexe e o solicite no tempo e forma especificados pola Escola.

Bibliografía. Fontes de información

Basic Bibliography

Frank M White, **Mecánica de Fluidos**, VI,

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

Antonio Crespo, **Mecánica de fluidos**, VIII,

Kundu, Pijush K., **Fluid Mechanics**, VI,

Batechelor, G. K., **An Introduction to fluid Dynamics**,

Complementary Bibliography

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

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

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

Kolev, N. I., **Multiphase Flow Dynamics 1**, III,

Kolev, N. I., **Multiphase Flow Dynamics 2**, III,

Crowe C.; Sommerfeld M.; Tsuji Y., **Multiphase Flows with Droplets and particles**, I,

Liñan, A. y Willians, F., **Fundamental Aspects of Combustión**, I,

Zhou, Yu, **Fluid- Structure-Sound Interactions and Control**, I,

Baker, G., **Differential Equetions as Models in Science and Engineering**,

Sengupta, T. K. ,Lele S. K., Sreenivasan, K. R. and Davison, P. A., **Advances in Computation, Modeling and Control of Transitional and Turbulent Flows**,

Sartra, S. and Witteveen J.A.S., **Uncertainty Quantification in Computational Science (theory and Application in Fluids and Structural Mechanics)**,

Recomendacións

Subjects that are recommended to be taken simultaneously

Termodinámica e transmisión de calor/V12G380V01302

Subjects that it is recommended to have taken before

Química: Química/V12G350V01205
Física: Física I/V12G380V01102
Física: Física II/V12G380V01202
Matemáticas: Álxebra e estatística/V12G380V01103
Matemáticas: Cálculo I/V12G380V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G380V01204

Other comments

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IDENTIFYING DATA				
Electronic technology				
Subject	Electronic technology			
Code	V12G350V01402			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Verdugo Mates, Rafael			
Lecturers	Pérez López, Serafín Alfonso Verdugo Mates, Rafael			
E-mail	rverdugo@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The objective of this course is to provide the students with the theoretical and practical fundamental knowledge in electronics' five main areas: analog electronics, digital electronics, industrial sensors, power electronics and communications electronics. In case of any discrepancy between this translation of the guide and the Spanish version, the valid one is the Spanish version.			

Training and Learning Results	
Code	
B3	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.
C11	CE10 Knowledge and use of the principles of circuit theory and electrical machines.
D2	CT2 Problems resolution.
D9	CT9 Apply 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 B4 B6 B10 B12 B17	C11 C24 C26 C27 C29	D1 D2 D2 D9 D10 D17
Know the electronic systems of conditioning and acquisition of data.	A1 A5	B1 B4	C2 C8 C11 C14	D1 D3 D10
Identify the different types of industrial sensors.	A1	B2	C1 C32	D1 D3 D4 D5 D6 D8 D10
Know the digital electronic systems basic.			C11	D2 D9 D17
Know the electronic circuits for the communication of information.	A1	B3	C1 C5	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

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Complementary Bibliography

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

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

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

Recommendations

Subjects that are recommended to be taken simultaneously

Fundamentals of automation/V12G380V01403

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Mathematics: Algebra and statistics/V12G380V01103
Mathematics: Calculus I/V12G380V01104
Mathematics: Calculus II and differential equations/V12G380V01204
Fundamentals of electrical engineering/V12G380V01303

IDENTIFYING DATA				
Automation and control fundamentals				
Subject	Automation and control fundamentals			
Code	V12G350V01403			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Armesto Quiroga, José Ignacio			
Lecturers	Armesto Quiroga, José Ignacio Diéguez González, Luis			
E-mail	armesto@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	In this subject present the basic concepts of the systems of industrial automation and of the methods of control, considering as central elements of the same the programmable programmable logic controller and the industrial controller, respectively.			

Training and Learning Results	
Code	
B3	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.
C12	CE12 Know the fundamentals of automation and control methods.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.
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	Training and Learning Results		
Purchase a global and realistic vision of the current scope of industrial automation systems.	B3	C12	D17 D20
Know which are the constitutive elements of an industrial automation system, its sizing and as they work.	B3	C12	D2 D6 D20
Knowledge applied on the programmable logic controllers, its programming and its application to industrial automation systems.	B3	C12	D2 D6 D9 D16 D17
General knowledge on the continuous control of dynamic systems, of the main tools of simulation of continuous systems and of the main devices of process control with greater interest to industrial level.	B3	C12	D3 D6 D17 D20
General concepts of the technicians of industrial controllers tuning.	B3	C12	D2 D9 D16

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

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

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	30	48
Problem solving	0	15	15
Lecturing	32.5	32.5	65
Essay questions exam	1.5	9.5	11
Essay questions exam	1.5	9.5	11

*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.
Essay questions exam	

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practical	It will evaluate each practice of laboratory between 0 and 10 points, in function of the fulfillment of the aims fixed in the billed of the same and of the previous preparation and the attitude of the students. Each practical will be able to have distinct weight in the total note.	20	B3	C12	D3 D6 D9 D16 D17 D20
Essay questions exam	Exam that may include essay questions and exercises, with a grade between 0 and 10 points.	40	B3	C12	D2 D3 D16
Essay questions exam	Exam that may include essay questions and exercises, with a grade between 0 and 10 points.	40	B3	C12	D2 D3 D16

Other comments on the Evaluation

- Continous Assesment of student work practices along established laboratory sessions will be held in the semester, with the assistance to them mandatory. In the case of not overcome, a review of practices, conditioned to having passed the script test, will take place in the second call, on a date after the script test, in one or more sessions and including the contents not passed in ordinary practice sessions.

- The assesment of the practices for students who officially renounces Continuous Assesment will be carried out in a review of practices, conditioned to having passed the script test, in the two calls, on a date after the script test, in one or more sessions and including the same contents of the ordinary practice sessions..
- It may demand previous requirements to the realisation of each practice in the laboratory, so that they limit the maximum qualification to obtain.
- It must pass both tests (script and practices) to pass the matter, give the total score at the rate indicated above. In case of no longer than two or one test, scaling may be applied to partial notes that the total does not exceed 4.5.
- In the final exam may establish a minimum score on a set of issues to overcome.
- In the second call of the the same course, students should examine the tests (script and/or practices) not passed in the first one, with the same criteria of that.
- According to the Rule of Continuous Assesment, the subject students to Continuous Assesment that present to some activity evaluable collected in the Teaching Guide of the matter, will be considered like "presented".
- Ethical commitment: student is expected to present an adequate ethical behavior. If you detect unethical behavior (copying, plagiarism, unauthorized use of electronic devices, and another ones), it follows that the student does not meet the requirements for passing the subject. In this case the global qualification in the present academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

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

Recommendations

Subjects that continue the syllabus

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

Subjects that are recommended to be taken simultaneously

Electronic technology/V12G380V01404

Subjects that it is recommended to have taken before

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

Other comments

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

IDENTIFYING DATA				
Resistencia de materiais				
Subject	Resistencia de materiais			
Code	V12G350V01404			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán Galego			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Pereira Conde, Manuel Riveiro Rodríguez, Belén			
Lecturers	Caamaño Martínez, José Carlos Pereira Conde, Manuel			
E-mail	manuel.pereira@uvigo.es 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.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C14	CE14 Coñecemento e utilización dos principios da resistencia de materiais.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D16	CT16 Razoamento crítico.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecer as diferencias entre sólido ríxido e sólido elástico.	B3	C14	D1
Coñecer os estados de tensión e deformación nun sólido deformable e a relación entre eles.	B4		D2
Aplicar o coñecemento adquirido á determinación dos valores máximos da tensión nun punto dun sólido deformable.			D9 D10
Coñecer os principios básicos que rexen a Resistencia de Materiais.			D16
Coñecer as relacións entre as diferentes solicitacións e as tensións que orixinan.			D17
Aplicar os coñecementos adquiridos á determinación de solicitacións.			
Aplicar os coñecementos adquiridos sobre tensións ó cálculo das mesmas en elementos barra.			
Coñecer os fundamentos das deformacións de elementos barra.			
Aplicar os coñecementos adquiridos ao dimensionamento de elementos barra.			

Contidos	
Topic	
1. Introdución de conceptos de estática necesarios para o estudio da Resistencia de materiais	1.1. Vector. Producto escalar e producto vectorial 1.2. Tipos de ligaduras. 1.3. Momento dunha forza 1.4. Equilibrio estático. Ecuacións. 1.5. Elementos sometidos a 2 ou 3 forzas 1.6. Forzas distribuidas e centroides 1.7. Reducción dun sistema de forzas a un sistema forza-par 1.8. Entramados e máquinas. Celosías. 1.9. Momentos e productos de inercia 1.10. Cables

2. Conceptos básicos da elasticidade e de resistencia de materiais	2.1 Tensións e deformacións. Sólido elástico 2.2 Relacións entre tensións e deformacións unitarias. 2.3 Principios de rixidez relativa e superposición. 2.4 Equilibrio elástico. 2.5 Solicitacións. Diagramas de esforzos
3. Tracción-compresión	3.1. Esforzo normal nun prisma mecánico. 3.2. Deformacións por tracción. 3.3. Problemas estáticamente determinados. 3.4. Problemas hiperestáticos. 3.5. Tracción ou compresión uniaxial producida por variacións térmicas ou defectos de montaxe
4. Pandeo	4.1. Fundamentos de Pandeo a compresión
5. Flexión e cortante	5.1. Vigas: definición e clases. Forzas aplicadas a vigas. 5.2. Esforzo cortante e momento flector. 5.3. Relacións entre esforzo cortante, momento flector e carga. 5.4. Diagramas de esforzos cortantes e momentos flectores. 5.5. Tipos de flexión. Hipótesis e limitacións. 5.6. Tensións normais no caso xeral de flexión desviada e seccións asimétricas. 4.7. Caso particular de flexión en seccións simétricas. Ley de Navier. 4.8. Concepto de módulo resistente. Seccións óptimas. 4.9. Análise de deformacións: xiros e frechas. Relación momento-curvatura. Ecuación da elástica. Teoremas para o calculo de deformacions 4.10 Flexión hiperestática
6. Outros esforzos	6.1. Fundamentos de cortadura 6.2. Fundamentos de torsión

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	30.5	40	70.5
Prácticas de laboratorio	9	23	32
Resolución de problemas	9	9	18
Exame de preguntas de desenvolvemento	3	0	3
Resolución de problemas e/ou exercicios	0	24.5	24.5
Exame de preguntas obxectivas	2	0	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente

	Description
Lección maxistral	Exposición dos contidos da materia, con apoio de pizarra e canón de vídeo.
Prácticas de laboratorio	Actividades de aplicación dos coñecementos a situacións concretas e de adquisición de habilidades básicas e procedimentais relacionadas coa materia de estudo.
Resolución de problemas	Resolución de problemas e exercicios

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	Os alumnos acudirán aos profesores para aclarar os conceptos necesarios para levar a cabo os problemas e / ou exercicios realizados na aula, así como para aclarar / debater calquera dúbida que poida aparecer despois do final das sesións presenciais. As sesións de titoría poderanse realizar por medios telemáticos (Campus Remoto, Moovi, etc.) baixo a modalidade de acordo previo.

Avaliación

	Description	Qualification	Training and Learning Results

Prácticas de laboratorio	Valorarase a asistencia e participación activa en todas as clases prácticas do cuadrimestre, así como a entrega en tempo e forma de toda a documentación solicitada nas mesmas (informes, memorias de prácticas, etc.). A parte presencial correspondente a cada práctica realízase nunha data determinada, polo que non é posible recuperar as faltas de asistencia. Escusaranse aquelas prácticas nas que o alumno presente un xustificante oficial (médico, xulgado,...) debidas a razóns inevitables. Puntuarase co valor indicado, a condición de que se alcance como mínimo o 45% da cualificación posible no exame final.	10	B3 C14 D1 B4 D2 D9 D10 D16 D17
Exame de preguntas de desenvolvemento	Exame escrito nas datas oficiais establecidas polo centro. Nota mínima para sumar na calificación global 45%(*). (*) Este mínimo rebaixarase ao 40% para os alumnos que teñan asistido e participado activamente en polo menos o 80% das actividades e clases realizadas en sesións de aula.	40	B3 C14 D1 B4 D2 D9 D10 D16 D17
Resolución de problemas e/ou exercicios	Ao longo do curso estableceranse 4 boletíns de problemas/exercicios para a resolución por parte do alumnado de forma autónoma. Estos boletín deberán entregarse resoltos nunhas datas establecidas polo profesorado da materia ao inicio do curso. A entrega deberá facerse únicamente a través da plataforma de teledocencia. Puntuarase o valor indicado, sempre que no exame final se alcance polo menos o 45%(*) da nota posible.	10	B3 C14 D1 B4 D2 D9 D10 D16 D17
Exame de preguntas obxectivas	Probas escritas para avaliar o traballo individual e o traballo en equipo realizado polo alumno ao longo do curso. Realizaranse 4 probas ao longo do curso nas datas que se lle comunicarán ao alumnado durante o transcurso da materia. Cada proba valorarase nun 10% da nota global da materia, sendo o total das probas valorado nun 40% da nota final. Para superar a materia será condición necesaria acadar polo menos o 40% da nota desta proba. Os alumnos que non acaden este mínimo (40%) sólo poderan superar a asignatura na convocatoria extraordinaria de segunda oportunidade mediante modalidade de avaliación global. Puntuarase o valor indicado, sempre que no exame final se alcance polo menos o 45%(*) da nota posible. (*) Este mínimo rebaixarase ao 40% para os alumnos que teñan asistido e participado activamente en polo menos o 80% das actividades e clases realizadas en sesións de aula. Os estudiantes que opten pola modalidade de avaliación global (renuncia á avaliación continua) farán un exame final consistente en: i) preguntas de desenvolvemento; ii) preguntas de carácter conceptual (previsiblemente tipo test). Este exame final será valorado co 100% da nota final da materia (60% exame de problemas; 40% cuestionario).	40	B3 C14 D1 B4 D2 D9 D10 D16 D17

Other comments on the Evaluation

Compromiso ético: espérase que o alumno mostre un comportamento ético adecuado. Se se detectan condutas pouco éticas (copia, plaxio, uso de dispositivos electrónicos non autorizados e outros), consideran que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso, suspenderase a nota global deste curso (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 suspenderase a nota global (0,0).

En caso de discrepancia entre os diferentes idiomas desta guía, prevalecerá a versión en galego.

Bibliografía. Fontes de información

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,

Recomendacións

Other comments

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

IDENTIFYING DATA				
Chemical engineering 1				
Subject	Chemical engineering 1			
Code	V12G350V01405			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	This is the first subject of "Specific Technology" that the student will take, so this subject represents the first contact between the student and the Chemical Engineering. It will introduce the concepts and methodologies of Chemical Engineering, which will be useful for the student, both for his later academic formation and for the development of his profession. The aim is that, at the end of the course, the students will know in depth the separation operations and will be able to propose and solve mass and/or energy balances, in situations of very diverse nature and complexity.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Know how to apply the mass and energy balances to systems with and without chemical reaction	B3	C19	D2 D6 D9 D10 D17
Know the mass tranfer principles	B3	C19	D10
Understand the principles of the Separation Process and apply them to real cases	B3 B4	C19	D2 D9 D17

Contents	
Topic	
Topic 1. Introduction to Chemical Engineering	1. Concept and evolution of Chemical Engineering. 2. Concept of Unit Operation and classification of them 3. General concepts: Operation regimes, contact types, etc.
Topic 2. Mass and Heat Balances	1. Macroscopic mass balances in steady state, with and without chemical reaction. 2. Macroscopic mass balances in unsteady state, with and without chemical reaction. 3. Macroscopic heat balances in systems with chemical reaction

Topic 3. Introduction to Mass Transfer	1. Basic Principles of Mass Transfer. 2. Individual and Global Mass Transfer Coefficients. 3. Phase Equilibria principles.
Topic 4. Separations Process	1. Absorption 2. Adsorption 2. Distillation/Rectification 3. Liquid-Liquid Extraction 4. Solid-Liquid Extraction 5. Ionic Exchange
Practices	1. Determination of the porosity of a packing. 2. Obtaining calibration curves and handling of measurement equipment. 3. Mass balance without chemical reaction and in unsteady state, in a continuous stirred tank. 4. Mass balance with chemical reaction and in unsteady state: Effect of temperature 5. Differential distillation of a binary mixture. 6. Solid-Liquid Extraction in several stages: Effect of the solvent on the performance of the process. 7. Liquid-Liquid extraction in one stage: Effect of the solvent.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	16	32	48
Laboratory practical	18	18	36
Problem solving	16	24	40
Autonomous problem solving	0	15	15
Objective questions exam	1.5	0	1.5
Problem and/or exercise solving	1.5	0	1.5
Report of practices, practicum and external practices	0	8	8

*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
Laboratory practical	Application of the knowledge acquired to the resolution of problems of Chemical Engineering, using equipment and facilities available in the laboratory/computer room.
Problem solving	Solving exercises with the teacher's help and independently
Autonomous problem solving	Autonomous solving of chemical engineering exercises

Personalized assistance

Methodologies	Description
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.
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

Assessment

	Description	Qualification	Training and Learning Results

Autonomous problem solving	(*)Exercicios e/ou "Probas parciais" que se fagan e entreguen ó profesor ó longo do curso, relacionados cos conceptos e contidos da materia. Ó longo do cuadrimestre cada alumno/a deberá entregar varios exercicios, resoltos de xeito autónomo. As competencias CG3 e CE19 avalianse en función das respostas do alumno ás cuestións de teoría e da resolución dos problemas plantexados. En ámbolos dous casos, o alumno, deberá aplicar coñecementos específicos desta materia xunto con coñecementos de materias básicas cursadas con anterioridade. As competencias CT2, CT9 e CT10 avalianse na resolución, por parte do alumno, de problemas relacionados co temario. Neste caso, además de saber aplicar coñecementos, tamén deberá demostrar a súa capacidade para resolver problemas de xeito autónomo.	25	B3 C19 D2 D9 D10
Objective questions exam	(*)Proba escrita na que o/a alumno/a deberá dar resposta a varias cuestións teóricas relacionadas co temario da materia. Ó longo do cuadrimestre faranse 1 ó 2 probas; De se facer dúas, unha delas terá lugar á metade do cuadrimestre (T-1) e outra ó remate das clases (T-2), en ámbolos dous casos nas datas fixadas polo centro. Cada unha delas avaliarase sobre 10 ptos e representará un 50% da valoración total deste item. De facerse unha única proba (T-3) ésta farase o remate das clases e na data fixada polo centro para os exames finais da materia. Neste caso a proba representará o 100% da valoración total do item. As competencias CG3, CG4 e CE19 avalíanse en función das respostas do alumno ás cuestións plantexadas. Tamén se avalía a competencia CT10 pois o resultado acadado nestas probas é unha medida do traballo feito polo alumno de xeito autónomo.	24	B3 C19 D10 B4
Problem and/or exercise solving	(*)Probas escritas que consisten na resolución de varios problemas relacionados co temario da materia. Ó longo do cuadrimestre faranse dúas probas, unha delas a metade do cuadrimestre (P-1) e outra ó remate das clases (P-2), en ámbolos dous caos nas datas fixadas polo centro. Cada unha delas avaliarase sobre un máximo de 10 ptos e representará un 50% da valoración total deste item. As competencias CE19, CT2 e CT9 avalíanse en base á resolución por parte do alumno de varios problemas de Enxeñería Química, para o cal terá que aplica-los coñecementos adquiridos no Aula. Tamén se avalía a competencia CT10 pois o resultado acadado nestas probas é unha medida do traballo feito polo alumno de xeito autónomo.	36	C19 D2 D9 D10

Report of practices, practicum and external practices	(*)Informe detallado sobre cada unha das prácticas feitas no laboratorio, no cal deberase explicar o traballo feito no laboratorio, incluir os datos obtidos, a sua análise e as conclusións que deles se deriven. Ademais, tamén deberase poñe-lo obxectivo da práctica e, de selo caso, incluir os fundamentos teóricos nos que se basa a práctica feita. Cada informe deberá entregarse individualmente na semán seguinte á de realización da práctica, e sempre antes de ter unha nova sesión de laboratorio. Consideraranse varios formatos diferentes de presentación dos resultados das prácticas: Memoria de prácticas, presentación en PowerPoint, póster, artígo científico, video, etc. En ningún caso, se avaliará o informe presentado por un/unha alumno/a que non fixera con anterioridade a práctica no laboratorio. As competencias CG3, CG4, CT6 e CT9 avalíanse en base á calidade do informe feito polo alumno ó rematar cada una das prácticas, valorándose a redacción, estructura e presentación do mismo, a análise e o tratamiento de resultados feito, así como as conclusión acadadas. A competencia CT17 avalíase en base ó traballo feito no laboratorio, onde as prácticas fanse en grupos de 2 alumnos. Además, o informe de prácticas débese elaborar e presentar en grupo.	15	B3 B4	D6 D9 D17

Other comments on the Evaluation

Sources of information

Basic Bibliography

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

Izquierdo, J.F. et al., **Introducción a la Ingeniería Química : problemas resueltos de balances de materia y energía**, Ed. Reverté,

Himmelblau, D.M., **Principios y Cálculos Básicos de la Ingeniería Química**, Ed. Prentice-Hall,

Complementary Bibliography

Wankat, P.C., **Ingeniería de Procesos de Separación**, Ed. Pearson Education,

Felder, R.M. y Rousseau, R.W., **Elementary Principles of Chemical Processes**, Ed. John Wiley & Sons,

McCabe, Smith, Harriott, **Operaciones Unitarias en Ingeniería Química**, Ed. McGraw Hill,

Recommendations

Subjects that continue the syllabus

Experimentation in industrial chemistry 1/V12G350V01505
Chemical engineering 2/V12G350V01503

Subjects that are recommended to be taken simultaneously

Fluid mechanics/V12G350V01401

Subjects that it is recommended to have taken before

(*)Física: Física I/V12G350V01102
(*)Física: Física II/V12G350V01202
Chemistry: Chemistry/V12G350V01205
Thermodynamics and heat transfer/V12G350V01301

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				
Basics of operations management				
Subject	Basics of operations management			
Code	V12G350V01501			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Mejías Sacaluga, Ana María			
Lecturers	García Lorenzo, Antonio Mejías Sacaluga, Ana María Sartal Rodríguez, Antonio			
E-mail	mejias@uvigo.es			
Web				
General description				

Training and Learning Results	
Code	
B8	CG8 Ability to apply the principles and methods of quality.
B9	CG9 Ability to organize and plan within the sphere of a company, and other institutions and organizations.
C15	CE15 Basic knowledge of production systems and manufacturing.
C17	CE17 Applied knowledge of business organization.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D7	CT7 Ability to organize and plan.
D8	CT8 Decision making.
D9	CT9 Apply knowledge.
D11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
D18	CT18 Working in an international context.

Expected results from this subject	Training and Learning Results		
□ Know the base on which support the activities related with the Organization and the Management of the Production.	B8 B9	C15 C17	D1 D2
□ Know the extent of the distinct activities related with the production.			D7
□ Purchase a vision of group for the execution of the activities related with the organization and management of the production.			D8 D9
□ Realize an assessment of the places of work from an approach that help to the development of the people with a perspective of eficiencia and equality			D11 D18

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

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

Planning

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

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

Methodologies

	Description
Lecturing	Presentation by the professor of the contents of the subject matter, theoretical bases and/or guidelines for the work, exercise or project to be developed by the student.
Practices through ICT	Activities that apply knowledge to specific situations and acquire basic and procedural skills related to the subject matter. These activities are carried out in special spaces with appropriate equipment.

Personalized assistance

Methodologies	Description
Lecturing	
Practices through ICT	

Assessment

	Description	Qualification	Training and Learning Results
Objective questions exam	2 Theory-Practical Exams of Equal Weight: Continuous assessment tests that will be given throughout the course, during theory classes and/or on dates designated by the School, distributed evenly and scheduled so as not to interfere with the rest of the subjects. Each of these tests (scored out of 10) will consist of a multiple-choice test (5 points) and an exercise section (5 points). To pass or compensate for this test, you must achieve at least 1.75 points in each section.	60	B8 C15 D1 B9 C17 D2 D7 D8 D9 D18
Laboratory practice	1 Practice Exercises: Continuous assessment test to be developed at the end of the practical sessions, in accordance with the academic schedule, on the date listed in the School's official calendar for first-chance exams.	40	B8 C15 D1 B9 C17 D2 D7 D8 D9 D18

Other comments on the Evaluation

ETHICAL COMMITMENT

Students are expected to display appropriate ethical behavior. If unethical behavior is detected (copying, plagiarism, use of unauthorized electronic devices, etc.), the student will be deemed not to meet the requirements to pass the course. In this case, the overall grade for the current academic year will be a fail (0.0). The use of any electronic device will not be allowed during assessment tests unless expressly authorized. Bringing an unauthorized electronic device into the examination room will be considered grounds for failing the course for the current academic year, and the overall grade will be a fail (0.0).

CONTINUOUS ASSESSMENT (grade out of 10)

All students, except those who opt for Comprehensive Assessment within the deadlines established by the School, will be

assessed using the Continuous Assessment method.

To pass the course through Continuous Assessment, the following points must be met:

1. It is essential to successfully complete the course practicals by attending them and submitting the answers to the exercises proposed and developed in the practical sessions. Only two absences will be allowed throughout the entire course for duly justified reasons, and students must also submit the answer to these or an equivalent assignment for recovery.

Important: Inappropriate behavior in class will be penalized as an absence. Likewise, if the practical assignment is submitted after the established deadlines, it will be counted as a missed assignment.

Once the limit of two absences is exceeded, the course cannot be passed through continuous assessment.

2. All tests must be passed (2 theoretical and practical tests and 1 exercise test) or have a passing average, with none of the grades for the different sections falling below 4 (the minimum grade required for compensation).

Students who pass the subject through Continuous Assessment may, if they wish to obtain a higher grade in any of the sections (except the practical section), take the test at the first opportunity of the official session for the subject and as established in the School's official examination schedule. It is important to know that the grades from all the tests taken will be taken into account for the final grade.

Students who do not pass the subject through Continuous Assessment, because they did not achieve a passing score or the minimum grade required for compensation in one of the two sections of the subject (with the exception of the practical section), may retake this section in the final test corresponding to the first opportunity for the subject and established in the School's official examination schedule.

Finally, once the first opportunity has been used, if the subject is not passed by Continuous Assessment, the corresponding test of the second opportunity of the official call (July) will include all parts of the subject.

OFFICIAL ANNOUNCEMENTS (grade out of 10)

Students who have opted out of Continuous Assessment will be assessed using the Global Assessment method and may be eligible for the highest grade.

Two situations are considered within the Global Assessment:

a) Students who successfully completed the practical assignments (i.e., who attended and submitted their results within the established deadlines) will take a test with a theoretical and practical component (60% of the grade) and a reduced practical exercise component (40% of the grade).

b) Students who do not meet the practical assessment requirement will take a test with a theoretical and practical component (60% of the grade) and an extended practical exercise component (40% of the grade).

FINAL GRADE

The student's final grade will be calculated from the scores on the various tests, taking into account their weighting (theoretical and practical tests 60% and the practical part 40%). In any case, passing the subject requires passing all sections or achieving a passing average with none of the grades lower than 4 (the minimum grade required for compensation).

In cases where the average grade for the different sections is equal to or higher than the passing mark, but the minimum score of 4 is not reached in any of the sections, the final grade will be a fail. For example, a student who obtained the following grades: 5, 9, and 1 would fail, even if the average score is >5, because one of the sections is below the minimum grade required for the subject (4). In these cases, the grade reflected in the transcript will be a fail (4).

Sources of information
Basic Bibliography
Jacobs F.R. y Chase, R.B, **Administración de Operaciones. Producción y cadena de suministros**, 16ª, McGraw-Hill, 2022
Domínguez Machuca, J.A. y otros, **Dirección de Operaciones: aspectos tácticos y operativos en la producción y los servicios**, McGraw-Hill, 1995
Krajewski, Ritzman y Malhotra, **Administración de Operaciones. Procesos y cadena de suministro**, Pearson, 2013
Complementary Bibliography
Rajadell, M., **Lean Manufacturing. Herramientas para producir mejor**, Díaz de Santos, 2021
Oficina Internacional del Trabajo, **Introducción al estudio del trabajo**, 4ª, OIT, 1996

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

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

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

Recommendations

IDENTIFYING DATA				
Tecnoloxía medioambiental				
Subject	Tecnoloxía medioambiental			
Code	V12G350V01502			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán Galego			
Department	En constitución Enxeñaría química			
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella Pérez López, Marta Torres Pérez, María Dolores			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Materia que pertence ó Bloque de "Materias Comúns da Rama Industrial" e que se imparte en tódolos Graos de Enxeñaría Industrial. Nesta materia lévase a cabo unha aproximación á Enxeñaría Ambiental, necesaria para abordar calquera proxecto no ámbito da Enxeñaría. Nela trabállanse áreas de Química e de Enxeñaría de procesos, coa finalidade de estudar o comportamento dos contaminantes e o seu efecto sobre o medio ambiente e seres vivos, de deseñar procesos físico-químicos para mitigar a contaminación, así como, de avaliar o impacto ambiental dos residuos xerados no proceso industrial. O obxectivo da materia é coñecer, entender e saber aplica-las técnicas empregadas, a escala industrial, en campos tan diversos como a xestión e tratamento de residuos, o tratamento de augas e/ou chans contaminados, o tratamento das emisións industrias contaminantes e a prevención da contaminación.			

Resultados de Formación e Aprendizaxe	
Code	
B7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
C16	CE16 Coñecementos básicos e aplicación de tecnoloxías ambientais e sustentabilidade.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral e escrita de coñecementos.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D12	CT12 Habilidades de investigación.
D17	CT17 Traballo en equipo.
D19	CT19 Sustentabilidade e compromiso ambiental. Uso equitativo, responsable e eficiente dos recursos.

Resultados previstos na materia		
Expected results from this subject	Training and Learning Results	
Coñece-la tecnoloxía existente para o control e tratamento de emisións gasosas contaminantes	C16	D2 D3 D10 D19
Coñece-los procesos básicos para o acondicionamento do auga e para o tratamento das augas residuais	C16	D2 D3 D10 D19
Coñece-lo funcionamento das estacións depuradoras das augas residuais	C16	D2 D3 D10
Coñece-lo proceso integrado de tratamento de residuos industriais	C16	D2 D3 D10 D19

Coñecer e saber aplicar as diferentes ferramentas de prevención da contaminación industrial	C16	D1 D2 D3 D9 D10 D12 D17 D19
Capacidade de analizar e avaliar o impacto social e medioambiental das solucións técnicas.	B7	D1 D3 D9 D10 D17 D19

Contidos	
Topic	
TEMA 1: Introdución á tecnoloxía medioambiental.	1. Economía do ciclo de materiais. 2. Introdución ás mellores técnicas dispoñibles (MTD, BAT).
TEMA 2: Xestión de residuos e efluentes.	1. Xeración de residuos: Tipos e clasificación. 2. Codificación de residuos. 3. Xestión de residuos urbanos. 4. Xestión de residuos industriais. Centro de tratamento de residuos industriais (CTRI). 5. Lexislación e normativa.
TEMA 3: Tratamento de residuos.	1. Valorización. 2. Tratamentos físico-químicos. 3. Tratamentos biolóxicos. 4. Tratamentos térmicos. 5. Xestión de vertedoiros.
TEMA 4: Tratamento de augas industriais e urbáns.	1. Características das augas residuais urbáns e industriais. 2. Estacións depuradoras de augas urbáns e industriais (EDAR). 3. Tratamento de lodos. 4. Depuración e reutilización de augas. 5. Lexislación e normativa.
TEMA 5: Contaminación atmosférica.	1. Tipos e orixe dos contaminantes atmosféricos. 2. Dispersión de contaminantes na atmosfera. 3. Efectos da contaminación atmosférica. 4. Tratamento de emisións contaminantes. 5. Lexislación e normativa.
TEMA 6: Sustentabilidade e impacto ambiental.	1. Desenvolvemento sostible. 2. Economía e análise do ciclo de vida. 3. Pegada ecolóxica e pegada de carbono. 4. Introdución ás técnicas de avaliación do impacto ambiental.
Práctica 1: Codificación de residuos.	
Práctica 2: Preparación de carbón activo inmovilizado para o seu emprego como adsorbente.	
Práctica 3: Eliminación de contaminantes mediante adsorción con carbón activo inmovilizado.	
Práctica 4: Coagulación-floculación: Establecemento das condicións óptimas de traballo.	
Práctica 5: Simulación de determinadas etapas dunha EDAR.	
Práctica 6: Análise do Ciclo de Vida dun producto.	

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	26	52	78
Resolución de problemas	11	22	33
Prácticas de laboratorio	12	12	24
Informe de prácticas, prácticum e prácticas externas	0	6	6
Estudo de casos	0	6	6
Exame de preguntas obxectivas	1.5	0	1.5

Resolución de problemas e/ou exercicios	1.5	0	1.5

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

Metodoloxía docente

	Description
Lección maxistral	Exposición no aula dos conceptos e procedementos chave para a aprendizaxe dos contidos do temario.
Resolución de problemas	Resolución de casos e exercicios coa axuda do profesor e de forma autónoma.
Prácticas de laboratorio	Aplicación dos coñecementos adquiridos á resolución de problemas de tecnoloxía ambiental, empregando os equipos e medios dispoñibles no laboratorio/aula informática.

Atención personalizada

Methodologies	Description
Prácticas de laboratorio	Durante as horas de titoría o alumnado pode consultar co/coa seu/sua profesor/a calquera dúbida sobre as prácticas feitas ou sobre o informe de prácticas a realizar. O horario de titorias do profesorado será público e accesible ó alumnado.
Lección maxistral	Durante as horas de titoría o alumnado pode consultar co/coa seu/sua profesor/a calquera dúbida surxida no desenvolvemento das clases e relacionada cos contidos vistos nas mesmas. O horario de titorias do profesorado será público e accesible ó alumnado.
Resolución de problemas	Durante as horas de titoría o alumnado pode consultar co/coa seu/sua profesor/a calquera dúbida surxida na resolución dos problemas plantexados no Aula. O horario de titorias do profesorado será público e accesible ó alumnado

Avaliación

	Description	Qualification	Training and Learning Results
Informe de prácticas, prácticum e prácticas externas	Informe detallado sobre cada unha das prácticas feitas, no que se incluirá unha explicación do traballo experimental feito, ademais dos resultados acadados, da análise dos mesmos e das conclusións que deles se deriven. As prácticas de laboratorio faranse en grupos de 2 alumnos, mais o/a profesor/a poderá esixir que o informe se entregue de xeito individual. Baixo ningunha circunstancia, se avaliará o informe entregado por un/unha alumno/a que non fixera previamente a práctica no laboratorio. Nas prácticas en aula informática, cada alumno/a traballará de xeito individual e, polo tanto, os informes de prácticas tamén serán individuais. Do mesmo xeito, soamente se avaliará o informe entregado por un/unha alumno/a que previamente asistirá a correspondente sesión de prácticas. As competencias CG7, CE16, CT1, CT3, CT9 e CT10 avalíanse en base á calidade do informe escrito feito, de xeito autónomo, polo alumno ó remate de cada práctica. Valorarase a redacción, estructura e presentación do mesmo, a análise e tratamento de resultados feito, asi como as conclusións acadadas. As competencias CT12 e CT17 avalíanse en base ó traballo feito no laboratorio, onde as prácticas fanse en grupos de 2 alumnos, e no transcurso do cal o alumno desenvolve habilidades de investigación eido da Tecnoloxía Medioambiental.	10	B7 C16 D1 D3 D9 D10 D12 D17

Estudo de casos	Todos aqueles exercicios, seminarios, traballos tutelados que poidan implicar aprendizaxe e servizo, casos prácticos e probas teórico/prácticas que se fagan e entreguen ó profesor ó longo do curso, relacionadas cos conceptos e contidos do temario. Ó longo do cuadrimestre faranse varias probas. As competencias CG7 e CE16 avalianse en base ás respostas do alumno ás cuestións de teoría plantexadas. As competencias CT2, CT10 e CT12 avalianse en base á resolución, por parte do alumno, de problemas de Tecnoloxía Medioambiental, sexa de xeito autónomo ou presencial, para o cal precisa buscar información adicional á aportada no aula. A competencia CT3 avaliase en ámbalas dúas partes, xa que os dous exames son escritos, en base á claridade e concreción das respostas.	30	B7 C16	D2 D3 D10 D12
Exame de preguntas obxectivas	Probas escritas nas que o alumnado deberá responder varias cuestións teóricas relacionadas co temario da materia. Ó longo do cuadrimestre faránse dúas probas, unha delas terá lugar a metade do cuadrimestre (T-1) e a outra ó remate das clases (T-2), e en ámbolos dous casos serán nas datas fixadas polo centro. Ámbalas dúas probas serán tipo test e en cada unha delas o alumnado deberá responder varias preguntas tipo test, de resposta múltiple. Cada proba (T-1 e T-2) avaliarase sobre 10 puntos e representará o 50% da valoración total deste item. As competencias CG7, CE16 e CT19 avalíanse en base ás respostas do alumnado ás cuestións plantexadas. Tamén se avalían as competencias CT1, CT3 e CT10 xa que a proba é escrita e esixe capacidade de análise e síntese por parte do alumnado.	30	B7 C16	D1 D3 D10 D19
Resolución de problemas e/ou exercicios	Probas escritas que consisten na resolución de varios problemas relacionados do temario da materia. Ó longo do cuadrimestre faranse dúas probas, unha delas (P-1) á metade do cuadrimestre e a outra ó remate das clases (P-2), e en ámbolos dous casos serán nas datas fixadas polo centro. En ambas probas o alumnado deberá resolver varios problemas relacionados coa temática vista nos temas suxeitos a avaliación. Cada unha delas (P-1 e P-2) avaliarase sobre 10 puntos e a sua calificación representará o 50% da valoración total deste item. As competencias CT2, CT9 e CT19 avalíanse nesta proba, en base á resolución por parte do alumnado de varios problemas de Tecnoloxía Medioambiental, para o cal precisará aplica-los coñecementos adquiridos na materia. Tamén se avalían as competencias CT1, CT3 e CT10 xa que a proba é escrita e esixe capacidade de análise e síntese por parte do alumnado.	30		D1 D2 D3 D9 D10 D19

Other comments on the Evaluation

Avaliación:

PRIMEIRA CONVOCATORIA

1. Modalidade de avaliación continua

Considerarase que un/unha estudante cursa a materia en ***réxime de avaliación continua*****,** sempre e cando non renunciara oficialmente a dita modalidade de avaliación, é decir, sempre que non solicitara oficialmente o cambio á "*modalidade de avaliación global*", nos prazos fixados pola dirección da E.E.I. a tal fin.

A cualificación final dos/as estudantes que cursen a materia en réxime de avaliación continua farase dacordo aos seguintes criterios:

A) ***Obrigatoriedade de facer tódalas probas*** *programadas nos apartados* **"*Exame de preguntas obxectivas*" (T-1** e **T-2**) *e* **"*Resolución de problemas e/ou exercicios*"** (**P-1** e **P-2**):

- Tódalas probas avaliaranse sobre un máximo de 10 puntos, de xeito que para aprobalas o/a estudante terá que acadar unha cualificación ≥ 5 puntos.
- NON aprobará a materia quen nalgunha das probas programadas (**T-1, T-2, P-1** *ou* **P-2)** non acade una nota ≥ 4 puntos.

B) ***Obrigatoriedade de face-las* "*Prácticas de laboratorio*"** *e* ***entrega-los informes correspondentes****:*

- As prácticas avaliaranse sobre un máximo de 10 puntos, de xeito que para aprobalas o/a estudante terá que acadar unha cualificación ≥ 5 puntos.
- NON aprobará a materia quen non acade una nota ≥ 4 puntos.
- Ademais, para supera-la materia un/unha alumno/a non poderá faltar, se causa xustificada, a mais de 1 práctica de laboratorio. *No caso de faltar a mais dunha práctica terá facer un exame das prácticas que non fixo.*

C) *O/A estudante que cumpra as condicións dos apartados (a) e (b) aprobará a materia* *a condición de que a* ***suma das cualificacións ponderadas obtidas en tódalas probas de avaliación*** **recollidas nesta guía *sexa ≥ 5 puntos*.**

En canto as probas "*Exame de preguntas obxectivas*" e "*Resolución de problemas e/ou exercicios*":

- As probas **T-1** e **P-1** faranse no mesmo dia, a metade do cuadrimestre e na data fixada pola E.E.I. para realiza-las probas de evaluación continua. Nelas o alumnado deberá dar resposta a varias preguntas teóricas tipo test e resolver problemas relacionados cos contidos dos tres primeiros temas do temario da materia.
- Se un/unha estudante **non acada unha nota ≥ 4 puntos** en algunha das probas (en **T-1** ou en **P-1)**, pero aproba a outra proba, na convocatoria extraordinaria (xullo) só deberá repeti-la proba suspensa.

- As probas **T-2** e **P-2** faranse no mesmo dia, unha vez rematadas as clases e na data fixada pola E.E.I. para a realización dos exames globais da 1ª convocatoria. Nelas o alumnado deberá dar resposta a varias preguntas teóricas tipo test e resolver problemas relacionados cos contidos dos tres derradeiros temas do temario da materia.
- Se un/unha estudante **non acada unha nota ≥ 4 puntos** en algunha das probas (en **T-2** ou en **P-2)**, pero aproba a outra proba, na convocatoria extraordinaria (xullo) só deberá repeti-la proba suspensa.

2. Modalidade de avaliación global

Aqueles estudantes aos que a Dirección da E.E.I. lles conceda o cambio *á* "*modalidade de avaliación global*" , farán un "exame final" de teoría e problemas (Exame de preguntas obxectivas + Resolución de problemas e/ou exercicios) que valerá o 90% da nota final, e un exame de prácticas que valerá o 10% da nota final. En calquera caso, para aproba-la materia, o alumno debe acadar o 50% da nota máxima en cada unha das partes que constitúen a materia, é dicir, teoría, problemas e prácticas.

CONVOCATORIA EXTRAORDINARIA OU 2ª CONVOCATORIA

Na **segunda convocatoria** aplicaranse os mesmos criterios.

En relación co exame de Xullo, manterase a cualificación da "Resolución de problemas de forma autónoma" e do "Informe de prácticas", sempre e cando se superase a nota mínima esixida na primeira convocatoria.

Se na 1ª convocatoria un/unha alumno/a aproba, cunha nota ≥ 5, algunha das probas recollidas en "Exame de preguntas obxectivas" (probas T-1 e T-2) ou en "Resolución de problemas e/ou exercicios" (probas P-1 e P-2), en Xullo soamente terá que repeti-la/s proba/s suspensa/s.

Compromiso ético:

Espérase que o alumno presente un comportamento ético axeitado. No caso de detectar un comportamento "non ético" (copia, plaxio, emprego de dispositivos electrónicos non autorizados, etc.) considerarase que o alumno non reúne os requisitos necesarios para supera-la materia. Nese caso a cualificación global no presente curso académico será de SUSPENSO (0,0 puntos).

Non se permitirá o emprego de ningún dispositivo electrónico durante as probas de avaliación, agás 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 ptos).

Bibliografía. Fontes de información

Basic Bibliography

Mihelcic, J.R. and Zimmerman, J. B., **Environmental Engineering: Fundamentals, sustainability, design**, Wiley, 2014

Davis, M.L. and Masten S.J., **Principles of Environmental Engineering and Science**, McGraw-Hill, 2014

Metcalf & Eddy, **Ingeniería de aguas residuales : tratamiento, vertido y reutilización**, McGraw-Hill, 1998

Acosta, J.A. et al., **Introducción a la contaminación de suelos**, Mundi-prensa, 2017

Complementary Bibliography

Tchobanoglous, G., **Gestión integral de residuos sólidos**, McGraw-Hill, 1996

Nemerow, N. L., **Tratamiento de vertidos industriales y peligrosos**, Diaz de Santos, 1998

Baird, C y Cann M., **Química Ambiental**, Reverté, 2014

Kiely, G., **Ingeniería Ambiental: fundamentos, entornos, tecnología y sistemas de gestión**, McGraw-Hill, 2001

Castells et al., **Reciclaje de residuos industriales: residuos sólidos urbanos y fangos de depuradora**, Díaz de Santos, 2009

Albergaria, J.M. and Nouws H.P.A., **Soil remediation**, Taylor and Francis, 2016

Sharma, H. D., and Reddy, K. R., **Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies**, John Wiley & Sons, 2004

Wark and Warner, **Contaminación del aire: origen y control**, Limusa, 1996

Jonker, G. y Harmsen, J., **Ingeniería para la sostenibilidad**, Reverté, 2014

Azapagic, A. and Perdan S., **Sustainable development in practice: Case studies for engineers and scientists**, Wiley, 2011

Reddy, K.R., Cameselle, C. and Adams, J.A., **Sustainable Engineering: Drivers, Metrics, Tools, and Applications**, Wiley, 2019

Recomendacións

Subjects that it is recommended to have taken before

Enxeñaría química I/V12G350V01405
Física: Física I/V12G360V01102
Física: Física II/V12G360V01202
Química: Química/V12G380V01205

Other comments

Recomendacións:
Para matricularse nesta materia é necesario ter superado ou ben estar matriculado de tódalas materias dos cursos inferiores ao curso no que está emprazada esta materia

IDENTIFYING DATA				
Enxeñaría química II				
Subject	Enxeñaría química II			
Code	V12G350V01503			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán Galego			
Department	En constitución Enxeñaría química			
Coordinator	Torres Pérez, María Dolores			
Lecturers	Pérez López, Marta Torres Pérez, María Dolores			
E-mail	matorres@uvigo.es			
Web				
General description	A misión do Enxeñeiro en Química Industrial é a de desenvolver procesos industriais, transformando os procesos de laboratorio en procesos de fabricación *industrialmente eficaces. O número de procesos químico-industriais é elevado pero todos eles poden *fraccionarse nunha serie de etapas ou operacións básicas que se repiten nos mesmos. Na materia Enxeñaría *Quimica *I, que se cursa no segundo cuadrimestre do segundo curso desta titulación, abórdanse algunhas destas operacións unitarias ou básicas (absorción, destilación, extracción, etc.). A materia Enxeñaría Química *II preséntase como a continuación da anterior materia, pretendendo completar o coñecemento destas operacións unitarias ou básicas de uso frecuente nos distintos tipos de Industria Química. Aínda que o número de horas da materia non permite un estudo exhaustivo de todas as non abordadas en segundo curso, preténdese unha introdución ao coñecemento das máis frecuentes e/ou das máis utilizadas nos procesos industriais. A aprendizaxe e traballo da materia debe contribuír, ademais, a consolidar a madurez persoal e social do alumno, promovendo unha forma de actuar responsable, tanto individual como *grupalmente.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C19	CE19 Coñecementos sobre balances de materia e enerxía, biotecnoloxía, transferencia de materia, operacións de separación, enxeñaría da reacción química, deseño de reactores, e valorización e transformación de materias primas e recursos enerxéticos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
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		
Coñecer e aplicar os principios das operacións de separación controladas pola transferencia *simultanea de materia e enerxía e pola transferencia de cantidade de movemento.	B3 B4	C19	D2 D6 D9 D10 D17
Coñecer e aplicar as principais operacións complementarias da industria da contorna e a súa influencia sobre os produtos.	B3 B4	C19	D2 D6 D9 D10 D17

Contidos
Topic

Operacións de separación controladas pola transferencia simultánea de materia e enerxía: Secado e Hidratación	1.1. Introducción 1.2. Secado de materiais: Parámetros característicos; Cinéticas de secado; Cálculo da velocidade e tempo de secado; equipos 1.3. Hidratación
Operacións de separación controladas pola transferencia de cantidade de movemento: sedimentación, filtración	2.1. Introducción 2.2. Sedimentación Conceptos xerais; Parámetros característicos; Equipos 2.3. Filtración Conceptos xerais; Parámetros característicos; Equipos
Operacións complementarias: esterilización, conxelación e ósmosis inversa	3.1. Tratamentos térmicos: Esterilización 3.2. Técnicas de conxelación e ultraconxelación 3.3. Operacións de separación con membranas: Ósmosis inversa; Características das membranas; Criterios de diseño

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	16.5	19.5	36
Resolución de problemas	16.5	28	44.5
Prácticas de laboratorio	12	18	30
Traballo tutelado	1.5	18.5	20
Resolución de problemas de forma autónoma	0	15	15
Presentación	1.5	0	1.5
Resolución de problemas e/ou exercicios	1.5	0	1.5
Exame de preguntas obxectivas	1.5	0	1.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Desenvolveranse nos horarios fixados pola dirección do centro. A través desta metodoloxía farase a presentación estruturada dos temas co fin de facilitar información organizada. Consistirá na exposición por parte do profesor dos contidos teóricos e prácticos da materia, mediante o uso de medios audiovisuais. Estimularase a participación dos/*as alumnos/*as a través da *formulación/contestación de preguntas, exposición de puntos de vista, etc
Resolución de problemas	A través desta metodoloxía realizarase a resolución de exemplos e exercicios ilustrativos da materia impartida nas sesións maxistrais co fin de facilitar a comprensión do material dado nas sesións maxistrais. Buscarase a interacción profesor-alumno solicitando a participación do alumno na resolución activa dos exercicios.
Prácticas de laboratorio	Realizaranse experiencias de laboratorio relacionadas co temario da materia. O alumno disporá dos guións de prácticas así como do material de apoio necesario para unha adecuada comprensión dos experimentos a levar a cabo. O alumno elaborará un informe final no que deberá recoller os principais resultados e conclusións
Traballo tutelado	Ao longo do curso, os alumnos elaborarán traballos utilizando diferentes ferramentas TIC para aplicar a aprendizaxe colaborativa na aula e fóra dela (Podcast educativos, infografías, minipresentacións, notas de voz, vídeos educativos, ...). Estes traballos poderán ser expostos en xornadas divulgativas a celebrar na escola.
Resolución de problemas de forma autónoma	Exporase a resolución de problemas relacionados coa materia, que serán resoltos mediante as ferramentas propostas na materia.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Resolución de problemas	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Prácticas de laboratorio	Durante as horas de *tutoría os alumnos, individualmente ou en grupo, poden consultar calquera dúbida exposta sobre o contido da práctica, tratamento de datos e resultados
Traballo tutelado	Durante as horas de *tutoría os alumnos, individualmente ou en grupo, poden consultar calquera dúbida exposta sobre a temática a desenvolver.

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas	Traballos e exercicios propostos polo profesor que comprendan os conceptos e procedementos craves contidos no temario	20	B3 B4	C19	D2 D6 D9 D10
Prácticas de laboratorio	Os estudantes realizarán diversas prácticas de laboratorio. Ao finalizar as diversas prácticas e nas datas indicadas deberán entregar os informes de prácticas	20	B3 B4		D9 D17
Traballo tutelado	O estudiantado formando equipas de traballo realizarán diversas trarefas apoiados nas TIC dos que deberán entregar memorias en diferentes formatos (vídeos, podcats, memorias, pósters) e tamén realizar unha defensa pública.	20	B4	C19	D10 D17
Resolución de problemas e/ou exercicios	A resolución de problemas é unha parte esencial desta materia, polo que no exame final avaliarase os coñecementos do alumno mediante a resolución de problemas	25	B3 B4	C19	D2 D9
Exame de preguntas obxectivas	No exame final o estudante terá que responder a unha serie de preguntas curtas ou cuestiones tipo test nas que terá que demostrar os seus coñecementos así como a súa capacidade de síntese	15	B3	C19	D9

Other comments on the Evaluation

Todos os estudantes serán avaliados de maneira preferente mediante Avaliación Continua empregando as metodoloxías de traballo tutelado, prácticas, exame de preguntas, así como a resolución de problemas.

Aqueles estudantes que dentro dos prazos marcados polo centro soliciten a súa renuncia á Avaliación Continua e esta sexa aceptada oficialmente serán avaliados pola modalidade de **Avaliación Global**.

Consideracións sobre a Avaliación Continua

Establécese unha cualificación mínima para o traballo tutelado, e as prácticas de laboratorio do 40% da cualificación máxima de cada ítem para a súa contribución á nota final. Cando non se alcance o mínimo esixido realizarase unha proba escrita durante a realización do exame final. **Resolución de problemas** (20%): ao longo do cuadrimestre os estudantes realizarán diferentes entregas de problemas, así como probas a realizar sen aviso previo na aula.

Traballo tutelado (20%): ao longo do cuadrimestre os estudantes deberán realizar un traballo en grupo no que utilizarán os diferentes coñecementos que está a adquirir na materia. As avaliacións da presentación final do traballo (memoria e presentación) constitúen un 20% da nota da materia correspondendo un 10% a memoria e un 10% a presentación que se realizará nun acto público. A non asistencia sen adecuada xustificación á presentación pública supón a cualificación de 0,0 nesta tarefa.

Prácticas de laboratorio (20%): durante o cuadrimestre os estuduntes realizarán prácticas de laboratorio que suporán un 20% da nota final de materia. Requírese unha asistencia mínima o 80% das prácticas para ter dereito á avaliación das mesmas. En caso contrario a nota deste apartado será 0,0 e terán que realizar un exame das mesmas no exame final.

Probas teóricas e problemas (15% y 25%, respectivamente): establécese unha calificación mínima en cada un destes dos ítems do 40% da calificación máxima para poder contribuir á nota final da materia.

NOTA FINALA nota final será a suma ponderada das notas obtidas en cada apartado a condición de que se alcance unha nota mínima no exame (50% da nota máxima entre as notas obtidas nas probas teóricas e de problemas). De non alcanzar a nota mínima no exame, está será a calificación que figurará na acta.

A participación do estudante nalgún dos actos de avaliación da materia implicará a condición de presentado/a e, por tanto, a asignación dunha cualificación en actas.

A cualificación global necesaria para aprobar a materia, resultante da suma ponderada de todos os apartados de avaliación, será de 5 puntos sobre 10.

Exame final 1ª oportunidade. Incluirá dúas probas separadas, unha de preguntas curtas ou tipo test e outra de resolución de problemas

SEGUNDA CONVOCATORIA

Na segunda convocatoria, manteranse a nota das metodoloxías avaliadas que superen na primeira convocatoria o 40% da nota máxima). Os estudantes que non obtivesen o 40% da nota máxima en calquera dos apartados deberán realizar un exame daqueles nesta segunda convocatoria.

Si ao alumno élle concedida a renuncia a avaliación continua unicamente será avaliado por un exame final dos contidos da materia (teóricos e prácticos) que será o 100% da nota.

Consideracións sobre estudantes con renuncia á avaliación continua (*EVALUACION GLOBAL): Estudantes con renuncia á avaliación continua realizarán un exame final composto de cuestións teóricas, de problemas e de prácticas. O exame suporá o 100% da nota, e para superar a materia esíxese un mínimo de 5 puntos sobre 10 en todas as partes da proba.

Compromiso ético: Espérase que o/o alumno/a presente un comportamento ético adecuado. No caso de detectar un

comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o/o alumno/a non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0).

Bibliografía. Fontes de información

Basic Bibliography

J.M. Coulson y J. F. Richardson, **Ingeniería química, tomo II : Unidades SI : operaciones básicas**, Editorial Reverté, 1981

Geankoplis, Christie Johm, **Procesos de transporte y principios de procesos de separación**, 4ª ed., México D.F. : CECSA : Grupo Editorial Patria,, 2006

McCabe, Warren L,, **Operaciones unitarias en Ingeniería Química**, 7ª Ed., McGraw-Hill, 2005

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Ángel Vian y Joaquín Ocón, **Elementos de Ingeniería Química: Operaciones básicas**, 5ª, Aguilar, 1979

Joaquín Ocón García, Gabriel Tojo Barreiro, **Problemas de Ingeniería Química: Operaciones Básicas. Tomo I y Tomo II**, Aguilar, 1982

Costa Novella, Enrique; Sotelo Sancho, José Luis, **Ingeniería química: conceptos generales**, 1ª, Alhambra, 1983

Treybal, Robert E., **Operaciones de Transferencia de masa**, 2ª, McGraw-Hill, 1994

Tejerina, F: Arribas, J.L.; Martínez, L.; Martínez, F.: Hernández Ramón, M.A., **Microfiltración, ultrafiltración y ósmosis inversa**, Universidad de Murcia, 1990

Recomendacións

Subjects that it is recommended to have taken before

Enxeñaría química I/V12G350V01405
Termodinámica e transmisión de calor/V12G350V01301

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				
Industrial chemistry				
Subject	Industrial chemistry			
Code	V12G350V01504			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Álvarez Álvarez, María Salomé			
Lecturers	Álvarez Álvarez, María Salomé Salgado Seara, José Manuel Torres Pérez, María Dolores			
E-mail	msaa@uvigo.es			
Web				
General description	The chemical industry represents one of the most powerful sectors in the economies of many countries, serving as a base for other industries such as steel, oil, food and electronics. Similarly, recent advances in high-performance materials, electronic devices, medical devices, together with new technologies to remedy environmental damage and increase productivity in agriculture, arise from innovations and continuous improvements developed in each of the stages of chemical processes. Therefore, in this subject it is intended to provide the student with a global vision of the Industrial Chemistry, from the elaboration and understanding of chemical processes flowsheets to the principles of quality that govern this sector. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.

Expected results from this subject	Training and Learning Results		
To know the most common operations for preparation and valorization of raw materials in chemical processes.	B3 B4	C19	D1 D2
To know the different techniques to minimize the amount of by-products and wastes.	B3 B4	C19	D1 D2
To identify energy resources and how to optimize their use.	B3 B4	C19	D1 D2
To acquire skills to perform and interpret industrial process flowsheets.	B3 B4	C19	D1 D2 D6

Contents	
Topic	
Introduction to industrial chemical processes.	General aspects of chemical processes. Characteristics and structure of the chemical industry sector. Situation of the Spanish chemical industry in the European and global context. Best Available Techniques.
Economics of industrial chemical processes.	Budget preparation . Analysis of costs and benefits. Economic viability criteria: Net Present Value, Internal Rate of Return, Return time.

Relevant industrial chemical processes: the industry of aluminum, paper, oil refining and biofuels.	- The aluminium industry: raw materials and properties, alumina manufacture, the Bayer process. - The paper industry: methods for pulp production, different technologies for the manufacture of paper, environmental issues, recycling of paper. - Petrochemistry: introduction to the petrochemical industry, general process flowsheet of a petrochemical refinery, different technologies for the transformation of crude oil to obtain added-value products. - Introduction to biotechnological processes: fundamental stages, conditioning of raw materials, biological reaction and recovery of products. - Biofuels: general characteristics and legal context, advantages, production of biodiesel and stages of the process, production of bioethanol and comparison of production strategies, production and applications of biogas.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Laboratory practical	12	7.5	19.5
Practices through ICT	2	2	4
Presentation	2	7	9
Problem solving	5	12	17
Lecturing	24	47	71
Mentored work	2	18	20
Problem and/or exercise solving	1	1	2
Essay questions exam	1	4	5
Objective questions exam	1	1	2

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

Methodologies

	Description
Introductory activities	In this activity the course syllabus will be presented to the students, as well as the objectives, competencies and evaluation criteria. Recommendations for course organization will be given, and groups for labwork, seminars and supervised work will be assigned.
Laboratory practical	Laboratory experiments and field practices in suitable industrial plants will be carried out. All the necessary support material will be provided, in order to ensure the understanding of the experiments and processes. The students will prepare a final report in which they must summarize the main results and conclusions, according to guidelines that will be available at the virtual campus. Laboratory practices will be evaluated together with field practices.
Practices through ICT	The students will carry out computer practices in which they will get familiarized with IT tools for the resolution of practical cases presented in theory and laboratory classes.
Presentation	The students will make an oral presentation of the project carried out as a supervised work, and will be evaluated by a jury composed of several lecturers from the Chemical Engineering Department and/or private sector professionals.
Problem solving	At the end of each lesson, the most relevant aspects will be discussed by solving practical cases and problems.
Lecturing	The lecturer will present the general aspects of the program in a structured way, with special emphasis on the fundamentals and most important or difficult to understand aspects. The lecturer will provide, through the virtual campus, the necessary material for a correct follow-up of the subject. The student will be able to work previously the material handed out by the lecturer and consult the recommended bibliography to complete the information.
Mentored work	The students will carry out a small project on a chemical manufacturing process, based on the technologies discussed during the course. A written memory will be presented.

Personalized assistance

Methodologies	Description

Introductory activities	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Lecturing	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Problem solving	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Mentored work	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Laboratory practical	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Practices through ICT	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.
Presentation	During tutorials, the students (either individually or in small groups) can ask questions about the topics discussed in the classroom, and receive guidance and additional support from the lecturer. This activity can also be carried out in a remote way (through email or virtual campus). The lecturers will indicate their tutorials schedule at the beginning of the course and through the virtual campus.

Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	The students will make some laboratory experiments focused on the transformation of raw materials into added value products. A report with the main experimental results and their discussion will be produced.	10	B4 C19 D1
Presentation	The project carried out as a Supervised work will be presented, and evaluated by a jury composed of lecturers from the Chemical Engineering Department and/or professionals from the private sector.	5	B3 C19 D1 B4 D2
Mentored work	During some practical sessions, the students will carry out a small project on a specific chemical process. The project will be presented, and evaluated by a jury, according to quality criteria previously established.	5	B3 C19 D1 B4 D2 D6
Problem and/or exercise solving	Written tests will be carried out, which will include short questions or exercises and problems, for the evaluation of the acquired competences in relation to the contents of the course.	35	B3 C19 D1 B4 D2
Essay questions exam	Written tests will be carried out, which will include essay questions, for the evaluation of the acquired competences in relation to the contents of the course.	35	B3 C19 D2 B4
Objective questions exam	At the end of each block of lessons, a short questions test will be proposed, thus allowing the students to assess their degree of achievement of the partial objectives.	10	

Other comments on the Evaluation

Details about evaluation and qualifications

1. Considerations on continuous evaluation.

- The participation of the student in any of the acts of evaluation of the course will imply the condition of presented and, therefore, the assignment of a qualification.
- Attendance at a minimum of 80% of laboratory practices is mandatory, which cannot be recovered.
- To pass the course, students must obtain at least a score of 5 points out of 10 in the partial exam and in the final exam, and a minimum of 4 points out of 10 in each of the other evaluation sections (laboratory practices, memory

and presentation of mentored work, objective questions exams). In any case, the overall qualification required to pass the course, resulting from the weighted sum of all the evaluation sections, will be 5 points out of 10.

- Students may waive the continuous assessment system through the procedure and within the period established by the School. If such resignation is requested and authorized, 100% of the grade will be assigned by taking a final exam, in which questions can be asked about all the topics taught in the course, including those corresponding to practical classes.

2. Considerations about the exams (partial and final).

- **Partial exam.** During the course there will be a partial and eliminatory test, which will include problems and/or exercises, as well as essay questions, and which will have a weight in the overall grade of 35 %. To pass this test, a score of at least 5 points out of 10 must be obtained.

- **Final exam 1st opportunity.** It will include the contents not evaluated in the partial test, and will have a relative weight of 35 % in the overall grade of the course. In case of not having passed the partial test, the students will be given the opportunity to repeat the evaluation of the corresponding contents, on the same date assigned for the final exam.

- **Final exam 2nd opportunity.** The exam may put forward questions about all the subjects taught in the course, including those corresponding to practical classes. Students who have obtained the minimum qualification established in this guide for the various evaluation sections (laboratory practices, memory and presentation of mentored work, objective question exams, partial exam), may only be assessed for the rest of the content.

3. Considerations on the qualification records

- **1st opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out (laboratory practices, memory and presentation of work, objective questions exams, partial exam and final exam), provided that the minimum required grades have been passed (4 points out of 10 in laboratory practices, memory and presentation of mentored work and objective questions exams, 5 points out of 10 in partial and final exams).

  In case of failing or not showing up for the partial and/or final exam, the record will reflect the Fail rating, with a numerical value resulting from the weighted sum of the lab, work, and objective question exam grades, applying the global grade contribution percentages specified in this guide; the contents approved in these three sections will be considered as passed with a view to the 2nd opportunity qualification record.

- **2nd opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out, provided that the minimum required marks have been passed.

  In case of failing or not taking the final exam, the record will reflect the Fail grade, with a numerical value resulting from the weighted sum of the lab, work, and objective question exam grades, applying the contribution percentages. to the global note specified in this guide.

Ethical considerations

The student is expected to exhibit an adequate ethical behavior. In 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 Fail (0.0).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The introduction of a non-authorized electronic device in the exam room will be considered a reason for not passing the subject in this academic year and the overall rating will be Fail (0.0)

Updated exam calendar: https://eei.uvigo.es/gl/alumnado/planificacion-academica/calendario-de-exames/

Lecturer acting as course coordinator: María Asunción Longo González

Sources of information

Basic Bibliography

Vian Ortuño, A., **Introducción a la Química Industrial**, Reverté, 1996

Ramos Carpio, M.A., **Refino de petróleo, gas natural y petroquímica**, Fundación Fomento Innovación Industrial, 1997

Casey, J.P., **Pulpa y papel: química y tecnología química**, Noriega, 1991

Díaz, M., **Ingeniería de bioprocesos**, Paraninfo, 2012

Camps M.M., **Los Biocombustibles**, Mundi-Prensa, 2002

Complementary Bibliography

Austin, G.T., **Manual de Procesos Químicos en la Industria**, McGraw Hill, 1993

Happel, J.; Jordan, D.G., **Economía de los procesos químicos**, Reverté, 1981

Atkins, J.W., **Making pulp and paper**, Tappi Press, 2004

De Juana S. J. M., **Energías renovables para el desarrollo**, Thomson Paraninfo, 2003

El-Mansi E.M.T., **Fermentation microbiology and biotechnology**, CRC/Taylor & Francis, 2007

Gary, J.H., **Refino de petróleo: tecnología y economía**, Reverté, 1980

Herranz Agustín, C., **Química para la ingeniería**, UPC, 2010

Rodríguez Jiménez, J., **Los controles en la fabricación de papel**, Blume, 1970

Recommendations

Subjects that continue the syllabus

Experimentation in industrial chemistry 2/V12G350V01602
Technical Office/V12G350V01604
Reactors and biotechnology/V12G350V01601

Subjects that are recommended to be taken simultaneously

Experimentation in industrial chemistry 1/V12G350V01505
Chemical engineering 2/V12G350V01503
Environmental technology/V12G350V01502

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405

Other comments

To enrol in this matter it is necessary to have passed or be enrolled in all the previous topics with respect to the year in which this course is taught.

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

IDENTIFYING DATA

Experimentación en química industrial I

Subject	Experimentación en química industrial I			
Code	V12G350V01505			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán Galego			
Department	Enxeñaría química			
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella			
E-mail	ealvarez@uvigo.es			
Web				
General description	O éxito na praxe da Química Industrial require non só coñecementos teóricos senón tamén habilidades prácticas. Xa sexa a nivel de deseño conceptual de proceso, laboratorio ou planta piloto, ou mesmo nos procesos a escala industrial, son numerosos os escenarios nos que o enxeñeiro se atopa ante a necesidade de experimentar. Ás veces trátase de entender un proceso a través das variables que lle afectan. Outras, de atopar os valores excelentes das mesmas, co fin de producir con menores custos, consumos enerxético, de materias primas ou minimizar os impactos ambientais. Tamén, deseñar unha planta ou obter datos para o deseño dunha nova. O obxectivo da materia "EXPERIMENTACIÓN EN QUÍMICA INDUSTRIAL", partes I e II, é capacitar ós alumnos para a realización das actividades experimentais da profesión da Química Industrial tales como: Operar con equipos de laboratorio para a separación/purificación de mesturas multicompoñentes, extraer principios activos de matrices sólidas, obter produtos de alto valor engadido mediante a utilización de reactores químicos ou determinar os parámetros cinéticos, termodinámicos ou de transferencia a considerar nas operacións propias da industria quimica.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C21	CE21 Capacidade para o deseño e xestión de procedementos de experimentación aplicada, especialmente para a determinación de propiedades termodinámicas e de transporte, e modelaxe de fenómenos e sistemas no ámbito da enxeñaría química, sistemas con fluxo de fluídos, transmisión de calor, operacións de transferencia de materia, cinética das reaccións químicas e reactores.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
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		
Coñecer as técnicas do deseño experimental aplicado á industria química e de proceso.	B3 B4	C21	D10
Deseñar e gestionar procedementos de experimentación aplicada.	B3 B4	C21	D2 D6 D9 D10 D17
Analizar os resultados dos procedementos experimentais aplicados a casos reais	B3 B4	C21	D6 D9 D10

Contidos

Topic	
TEMA 1. Determinación da incerteza das medidas na industria química.	1.1. Desenvolvemento de cálculos de Enxeñería Química en folla Excel. 1.2. Tratamento e validación dos datos experimentais na Química Industrial. 1.3 Axuste da variación de parámetros e constantes a modelos empregados nos procesos de Enxeñería Química.
TEMA 2. Determinación de propiedades termodinámicas e de transporte, e de parámetros de transferencia de masa/enerxía.	2.1. Análise de propiedades físicas e de transporte de sustancias, en diferentes condicións de traballo. 2.2. Determinación de parámetros de transferencia de masa/enerxía aplicada a Operacións de Separación e a sistemas con fluxo de fluídos e transmisión de calor. 2.3. Manexo de bases de datos.
TEMA 3. Experimentación orientada	3.1. Validación de datos e detección de erros nun experimento. 3.2. Determinación experimental de propiedades físicas e de transporte de sustancias ou mesturas. 3.3. Determinación experimental de parámetros en sistemas multifásicos: líquido-vapor, líquido-líquido, sólido-líquido, gas-líquido, etc 3.4. Traballo con unidades operativas básicas monofásicas e bifásicas: Axuste dos datos experimentais a modelos.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	7.5	15	22.5
Resolución de problemas	12	24	36
Prácticas de laboratorio	24	30	54
Traballo tutelado	6	14	20
Resolución de problemas e/ou exercicios	0	13.5	13.5
Exame de preguntas obxectivas	0	4	4

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

Metodoloxía docente

	Description
Lección maxistral	Exposición en clase dos conceptos e procedementos craves para a aprendizaxe do contido do temario.
Resolución de problemas	Actividade na que se formulan problemas e/ou exercicios relacionados coa materia, ós cales o alumnado debe dar unha solución axeitada ou correcta.
Prácticas de laboratorio	Realización das experiencias de laboratorio que figuran nos contidos.
Traballo tutelado	Proxecto experimental realizado polo estudante, de xeito individual ou en grupo, no cal poña en práctica os coñecementos adquiridos na materia.

Atención personalizada

Methodologies	Description
Lección maxistral	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Prácticas de laboratorio	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Resolución de problemas	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Traballo tutelado	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).

Avaliación

	Description	Qualification	Training and Learning Results
Prácticas de laboratorio	Considerarase a asistencia, a actitude, a participación e a calidade do traballo realizado no laboratorio. Os informes deberán ser entregados individualmente na semán seguinte á realización da práctica, e sempre antes de realizar unha nova sesión de laboratorio. Considéranse varios formatos diferentes de presentar os resultados das prácticas: Memora de prácticas, presentación de PowerPoint, póster, artigo de investigación, video, etc. Cada informe, en calquera dos formatos, debe conter unha explicación do traballo feito no laboratorio, os datos obtidos e a súa análise, e as conclusións derivadas deles. Ademáis, tamén débese inclui-lo obxetivo da práctica e, no seu caso, os fundamentos teóricos aplicados. Asimesmo, e con independencia do formato empregado, os informes de prácticas poderán presentarse en galego, castelán ou inglés, mais no formato "artígo de investigación" se lle recomenda ó alumnado que empregen o inglés. Baixo ninguna circunstancia se avaliará o informe presentado por un/unha alumno/a que non fixera antes a práctica no laboratorio. As competencias CG3, CG4, CT6 CT9, e CE21 avalíaranse en base ás entregas do alumno/a ó reematar cada unha das prácticas, dependendo do formato, por rúbrica. A competencia CT17 avalíase en base ó traballo realizado no laboratorio, onde as prácticas realízanse en grupos de 2 alumnos.	30	B3 C21 D9 B4 D17
Traballo tutelado	Cada alumno/a deberá facer un proxecto individual ou en grupo de 2 persoas (dacordo cos profesores) e entrega-lo, polo menos 15 días antes de rematar as clases, no formato de memorándum. Este proxecto terá por obxecto o deseño dun experimento real que combine varias das técnicas estudadas nas sesións de prácticas, a execución do mesmo, a análise e presentación dos resultados obtidos, e a elaboración dun documento escrito que sirva de "guión" nun futuro. O proxecto realizado tamén deberá expoñerse públicamente, ante un tribunal ou en actividades programadas con iste fin, antes do inicio do periodo oficial de exames. A data da exposición publicarase ao inicio da materia. En ningún caso, se avaliará o proxecto presentado por un/unha alumno/a que non participase en tódalas fases da súa elaboración, incluida a súa exposición pública. Avalíanse as competencias CG3, CG4, CE21, CT10 coa proposta feita para resolve-lo problema experimental plantexado. As competencias CT2, CT6, CT9 e CT10 avalíanse en función da calidade do traballo realizado no laboratorio e do informe elaborado ao remate da proba. Valorarase a redacción, estructura e presentación dos mesmos, a análise e tratamento de datos feito, así como as conclusións acadadas. A competencia CT17 avalíase a partir do traballo feito nas fases de escolla, deseño, execución e exposición pública, pois en todas elas o alumnado traballa en equipos de 2 alumnos.	30	

Resolución de problemas e/ou exercicios	Exercicios que se fagan e entreguen ao profesor ó longo do curso, en relación cos contidos da materia vistos nas clases de teoría. Ó longo do curso cada alumno/a deberá entregar varios exercicios resoltos, que nalghun caso serán exercicios resoltos no mesmo aula e, noutros casos, serán exercicios que deberá resolver de forma autónoma. As competencias CG3 e CG4 avalíanse en función da resolución dos problemas plantexados, para o cal o alumno deberá aplicar os coñecementos específicos desta materia xunto con coñecementos de materias básicas cursadas con anterioridade. As competencias CT2, CT9, CT10 e CE21 avalíaranse coa resolución, por parte do/a alumno/a, de problemas relacionados co temario. Neste caso, ademais de saber aplicar coñecementos, tamén deberá demostrar a súa capacidade para resolver problemas de maneira autónoma	10	B3 C21 D2 B4 D9 D10
Exame de preguntas obxectivas	A proba final de avaliación farase ao final do período de clases, na data fixada polo centro. A proba, que é de carácter teórico-práctico, consistirá na resolución de problemas curtos e/ou casos prácticos. Nela avaliarase a asimilación por parte do alumno dos conceptos teóricos e prácticos desenvolvidos na materia. As competencias CG3, CG4 e CE21 avalíanse no exame de teoría, en función das respostas do alumno ás preguntas plantexadas. As competencias CE21, CT2 e CT9 avaliaranse no exame de problemas, en base á resolución de varios problemas de Enxeñaría Química, para o que terá que aplicar coñecementos adquiridos na aula. A competencia CT10 avaliarase en ámbalas duas partes, xa que os dous exames esixen a capacidade de análise e síntese. Ademais, nos dous casos, o resultado obtido é unha medida do traballo autónomo feito.	30	B3 C21 D2 B4 D9 D10

Other comments on the Evaluation

Criterios a seguir para a cualificación final

PRIMEIRA CONVOCATORIA

1. Modalidade de avaliación continua

Considerarase que un/unha estudante cursa a materia en ***réxime de avaliación continua***, sempre e cando non renunciara oficialmente a dita modalidade de avaliación, é decir, sempre que non solicitara oficialmente o cambio á "modalidade de *avaliación global*", nos prazos fixados pola dirección da E.E.I. a tal fin.

A cualificación final dos/as estudantes que cursen a materia en *réxime de avaliación continua* farase dacordo aos seguintes criterios:

(a) *Obrigatoriedade de facer e aproba-lo* "*Exame de preguntas obxectivas*", *as* "*Prácticas de laboratorio*"*e o* "*Traballo tutelado*":

- NON aprobará a materia quen non faga e aprobe estas tres probas (exame de preguntas obxectivas, prácticas de laboratorio e traballo tutelado).
- Tódalas probas avaliaranse sobre un máximo de 10 puntos, de xeito que para aproba-las o/a estudante terá que acadar unha cualificación ≥ 5 puntos.

(b) *O/A estudante que cumpra a condición dada no apartado (a)* aprobará a materia a condición de que a suma das cualificacións obtidas en tódalas probas de avaliación recollidas nesta guía sexa ≥ 5 puntos.

2. Modalidade de avaliación global

Aqueles estudantes aos que a Dirección da E.E.I. lles conceda a "*renuncia á avaliación continua*" terán que facer e aprobar un exame final consistente en:

i) Resolución de problemas curtos (30% da nota total)

ii) Cuestións sobre fundamentos teóricos da experimentación (10% da nota total)

iii) Cuestións relacionadas coa experimentación no laboratorio (60% da nota total).

SEGUNDA CONVOCATORIA

Para os/as estudantes que cursaron a materia en ***réxime de avaliación continua****:* Manterase a cualificación da proba "Resolución de problemas e/ou exercicios" e o/a alumno/a deberá repetir aquelas outras probas nas que, na primeira convocatoria, non acadou a nota mínima esixida.

Para o estudiantado que siga a ***modalidade de avaliación global:*** *R*exen os mesmos criterios que na primeira convocatoria.

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

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Zlokarnik, **Scale-up in Chemical Engineering**, Wiley-VCH, 2006

Zivorad R. Lazic, **Design of experiments in Chemical Engineering. A Practical Guide**, Wiley-VCH, 2005

Richard Brereton, **Data Analysis for the Laboratory and Chemical Plant**, Wiley, 2003

Himmelblau y Bischoff, **Análisis y simulación de procesos**, Reverté, 2004

Complementary Bibliography

Recomendacións

Subjects that continue the syllabus

Experimentación en química industrial II/V12G350V01602

Subjects that are recommended to be taken simultaneously

Enxeñaría química II/V12G350V01503

Subjects that it is recommended to have taken before

Matemáticas: Álxebra e estatística/V12G350V01103
Enxeñaría química I/V12G350V01405
Mecánica de fluídos/V12G350V01401
Termodinámica e transmisión de calor/V12G350V01301

IDENTIFYING DATA				
Reactors and biotechnology				
Subject	Reactors and biotechnology			
Code	V12G350V01601			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Pazos Currás, Marta María			
Lecturers	Díez Sarabia, Aida María Pazos Currás, Marta María Pérez López, Marta			
E-mail	mcurras@uvigo.es			
Web				
General description	This subject provides the basis for chemical reaction engineering and biotechnology. Chemical reaction engineering is concerned with the design and operation of chemical reactors. It can be said to be the discipline that quantifies the influence of transport phenomena and kinetics, in order to relate reactor performance to inlet conditions and variables. For this task, it is required basic skills in chemistry, thermodynamics and kinetics, fluid mechanics and transport phenomena, physics, biochemistry, etc. Performance, selectivity or production can be considered as measurements of operation, whereas feeding and operating conditions constitute the inlet variables. Single or multiphase fluid mechanics determine the contact, while the kinetic description relates the reaction rate to intensive variables such as concentrations, temperature, pressure, catalyst activity, etc. Thus, chemical reaction engineering is the methodology for reactive chemical systems, where the cause-effects observed in laboratories need to be scaled up and operated industrially, which allows to deal in a unified way with any reaction problem regardless of its chemical nature or specific industry. On the other hand, students will also be introduced to the field of biotechnology. Although the concept of biotechnology has had many definitions, in general terms, biotechnology is the technology based on the use of biological systems and living organisms or their derivatives for the creation or modification of products or processes for specific uses. This part of the subject aims to provide the student with an overview of some of the processes of the biotechnology industry, highlighting the importance of changing scales and the existing problems regarding the environment, energy and natural resources. English Friendly subject: International students may request the following from the teaching staff: a) materials and bibliographic references to follow the subject in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D5	CT5 Information Management.

Expected results from this subject	Training and Learning Results		
Comprise the basic appearances of the Engineering of the chemical reactions.	B3 B4		D1 D2 D5
Know the fundamental appearances in the design of reactors for his application to productive processes	B4	C19	D1 D2 D5
Purchase skills on the process of analysis and interpretation of kinetical data and his application to the design of reactors		C19	D1 D2

Know the basic principles, physical factors, chemists and biological, on which supports the Biotechnology	B3	C19	D1

Contents	
Topic	
Basic principles of biotechnology	Biotechnological Processes General diagram of a biotechnological process Bioreactors Immobilization Recovery and purification of products
Chemical kinetics. Analysis and interpretation of rate data. Multiple reactions	Chemical reaction kinetics Microbial kinetics Enzyme kinetics
Design of isothermal and no isothermal reactors	Ideal reactors Flow models Reactors in state stationary
Residence time distribution in chemical reactors Non-ideal reactor models	Real reactor model
Catalysis and catalytic reactors Diffusion and reaction. Effects of external diffusion in heterogeneous reactions	Basic concepts of catalysis Characteristic of the catalytic systems Catalytic reactors

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	20	18	38
Problem solving	29	58	87
Laboratory practical	20	20	40
Presentation	1	12	13
Introductory activities	4	4	8
Case studies	4	30	34
Essay questions exam	2	0	2
Objective questions exam	2	0	2
Oral exam	1	0	1
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	Description
Lecturing	Presentation by the teacher of the general aspects of the programme in a structured way, with special emphasis on the fundamentals and the most important or difficult aspects for the student to understand. The professor will facilitate, through the platform MOOVI, the necessary material for a correct follow-up of the matter. The student will have to work previously the material delivered by the professor and consult the bibliography recommended to complete the information.
Problem solving	During the development of the subject, the resolution of questions and problems will be used in order to reinforce the aspects presented in the lectures.
Laboratory practical	Laboratory experiments and field trips to companies related to chemical reaction engineering and biotechnology will be carried out. The student will be provided with practice scripts as well as the necessary support material for a proper understanding of the experiments to be carried out. The student will prepare a final report in which the main results and conclusions will be presented.
Presentation	The students will make a presentation of the CASE STUDY carried out, and will be assessed by an examining board made up of the lecturers of the subject.
Introductory activities	In this activity, students will be introduced to the syllabus and practices to be developed during the course, as well as the objectives, competences and evaluation criteria. Likewise, the way the course will be developed will be explained to them, and the groups that will carry out the work and practicals will be created.
Case studies	Along the course, students will develop a group work, a CASE STUDY , related to the subject of the course, which will be proposed by the teachers using various scientific articles as starting material.

Personalized assistance	
Methodologies	**Description**

Lecturing	During the hours of tutorships the students, individually or in group, can consult with the professors any doubt posed on the matter. The teacher will inform on the available schedule in the presentation of the matter.
Problem solving	During the hours of tutorships the students, individually or in group, can consult with the professors any doubt posed on the matter. The teacher will inform on the available schedule in the presentation of the matter.
Laboratory practical	During the hours of tutorships the students, individually or in group, can consult with the professors any doubt posed on the matter. The teacher will inform on the available schedule in the presentation of the matter.
Case studies	During the hours of tutorships the students, individually or in group, can consult with the professors any doubt posed on the CASE STUDY . The teacher will inform on the available schedule in the presentation of the matter.

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	This matter is mainly practical, so the best way to evaluate the student's knowledge is by means of problem solving and activities H5P	5	B3 B4	C19	D2
Laboratory practical	Students will carry out different laboratory practicals and field trips. At the end of the various practicals and on the dates indicated by the teachers, they will have to hand in the practical reports and complete a questionnaire on the field trips.	10	B3 B4		
Presentation	Students must present a CASE STUDY which will be assessed by an examining board made up of the lecturers of the subject.	10	B3 B4		D1
Case studies	Students will carry out a CASE STUDY as a group. This activity will be worth 10% of the final grade.	10	B4		D1 D5
Essay questions exam	This subject is mainly practical, so in the final exam the student's knowledge will be assessed by solving problems.	30	B3 B4	C19	D2
Objective questions exam	After each topic, different exams will be taken, the student will have to answer a series of short questions or multiple choice questions in which you will have to demonstrate your knowledge as well as your ability to synthesize. Likewise, throughout the semester, QUIZZI-type tests may be carried out that may represent a 0.5 + the grade assigned to this section.	25	B3		D1
Oral exam	There will be an individual oral examination of the laboratory practicals carried out in the course.	10	B3 B4		D1

Other comments on the Evaluation

CONTINUOUS ASSESSMENT

All students will be continuously assessed through the development of a CASE STUDY, practicals, quizzes, and tests, as well as problem-solving tasks.

PROBLEM-SOLVING (5%):

Throughout the course, students will complete various deliverables related to problem-solving, as well as H5P activities.

CASE STUDY (20%):

Over the semester, students will work in groups on a project where they will apply the knowledge acquired in the course. The instructor will schedule follow-up seminars to evaluate the project's progress. The partial evaluations of the deliverables during the course and the final evaluation of the project's report and presentation account for 20% of the final grade, with 10% for the report and follow-up and 10% for the presentation.

LAB PRACTICALS AND STUDY TRIPS (20%):

During the semester, students will participate in lab practicals and study trips, accounting for 20% of the final grade. The total grade for practicals and study trips is divided as follows: 10% for an individual oral exam on the practicals and 10% for the practicals report and study trip test. A minimum attendance of 80% for the practicals and study trips is required to be eligible for their evaluation. Otherwise, the grade for this section

will be 0.0, and the student must take an exam on them during the final exam. Additionally, a minimum of 40% must be achieved in the practicals; failing to do so will require the student to take a practicals exam during the final exam.

QUIZZES AND TESTS (25%):

Throughout the semester, preferably after each topic, quizzes or short-answer tests may be administered, constituting 25% of the grade. Additionally, QUIZZI tests may be given, potentially adding up to 0.5 bonus points.

FINAL MARK

The final mark will be the sum of the marks obtained in each section, provided a minimum grade is achieved in the objective question exams (40% of the maximum grade of 2.5) and in the development question exam (50% of the maximum grade of 3). If the minimum grade is not achieved in the exams, the sum of these grades will be the qualification recorded.

SECOND EXAMINATION SESSION

In the second session, the practicals grade from the first session (if it reached 40% of the maximum grade) and the grades from the CASE STUDY and PROBLEM-SOLVING sections will be maintained. Students who did not achieve 40% of the maximum grade in the practicals will need to take an exam on them in the second session.

WAIVER OF CONTINUOUS ASSESSMENT/GLOBAL ASSESSMENT

Students may opt to be assessed by a final exam covering all course content (theoretical and practical), which will constitute 100% of the grade.

ETHICAL COMMITMENT

Students are expected to exhibit appropriate ethical behavior. If unethical behavior (e.g., cheating, plagiarism, unauthorized use of electronic devices) is detected, the student will be considered as not meeting the requirements to pass the course, resulting in a final grade of fail (0.0) for the academic year. No electronic devices are allowed during evaluation tests unless expressly authorized. Introducing an unauthorized electronic device into the exam room will be grounds for failing the course, resulting in a final grade of fail (0.0)

Sources of information

Basic Bibliography

Fogler, H.S., **Elementos de Ingeniería de las Reacciones Químicas**, 4ª, Prentice Hall, 2008

Levenspiel, O., **Ingeniería de las Reacciones Químicas**, Reverté, 2004

González, J.R., González, J.A, González, M.P., Gutiérrez J.I. y Gutiérrez M.A., **Cinética Química Aplicada**, Síntesis, 1999

Santamaría, J., Herguido, J., Menéndez, M.A. y Monzón, A., **Ingeneniería de Reactores**, Síntesis, 1999

Gòdia Casablancas F. y López Santín J, **Ingeniería Bioquímica**, Síntesis, 1998

García-Segura, J.M. et al, **Técnicas instrumentales de análisis en bioquímica**, Sintesis, 1996

Complementary Bibliography

Coker, A.K., **Modeling of chemical kinetics and reactor design**, 2ª, Butterworth-Heinemann, 2001

Levenspiel, O., **El Omnilibro de los Reactores Químicos**, Reverté, 1986

Delannay, F., **Characterization of heterogeneous catalysts**, Marcel Dekker, 1984

Izquierdo, J. F., **Problemas resueltos de cinética de las reacciones químicas**, Ediciones Libreria Universitaria, 2019

Izquierdo, J. F., **Cinética de las reacciones químicas**, Ediciones Libreria Universitaria, 2019

Recommendations

Subjects that continue the syllabus

Modelling of biotechnological processes/V12G350V01924

Biotechnological processes and products/V12G350V01922

Subjects that are recommended to be taken simultaneously

Technical Office/V12G350V01604

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405

Chemical engineering 2/V12G350V01503

Industrial chemistry/V12G350V01504

Other comments

To enrol in this subject it is necessary to have passed or enrolled in all the subjects of the courses lower than the course in which this subject is located.

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

IDENTIFYING DATA				
Experimentación en química industrial II				
Subject	Experimentación en química industrial II			
Code	V12G350V01602			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	2c
Teaching language	Castelán Galego			
Department	Enxeñaría química			
Coordinator	Torres Pérez, María Dolores			
Lecturers	Torres Pérez, María Dolores			
E-mail	matorres@uvigo.es			
Web				
General description	O éxito na praxe da Química Industrial require non só coñecementos teóricos senón tamén habilidades prácticas. Xa sexa a nivel de deseño conceptual de proceso, laboratorio ou planta piloto, ou mesmo nos procesos a escala industrial, son numerosos os escenarios nos que o enxeñeiro se atopa ante a necesidade de experimentar. Ás veces trátase de entender un proceso a través das variables que lle afectan. Outras, de atopar os valores excelentes das mesmas, co fin de producir con menores custos, consumos enerxético, de materias primas ou minimizar os impactos ambientais. Tamén, deseñar unha planta ou obter datos para o deseño dunha nova. O obxectivo da materia "EXPERIMENTACIÓN EN QUÍMICA INDUSTRIAL", partes I e II, é capacitar ós alumnos para a realización das actividades experimentais da profesión da Química Industrial tales como: Operar con equipos de laboratorio para a separación/purificación de mesturas multicompoñentes, extraer principios activos de matrices sólidas, obter produtos de alto valor engadido mediante a utilización de reactores químicos ou determinar os parámetros cinéticos, termodinámicos ou de transferencia a considerar nas operacións propias da industria quimica.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C21	CE21 Capacidade para o deseño e xestión de procedementos de experimentación aplicada, especialmente para a determinación de propiedades termodinámicas e de transporte, e modelaxe de fenómenos e sistemas no ámbito da enxeñaría química, sistemas con fluxo de fluídos, transmisión de calor, operacións de transferencia de materia, cinética das reaccións químicas e reactores.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
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		
Profundizar no deseño e execución de experimentos de laboratorio e analizar os resultados obtidos e a extracción de conclusións.	B4	C21	D10
Coñecer os principios de operación dos principais equipos a escala de laboratorio na Química Industrial. Diagnosticar de forma empírica e simulada problemas de operación en equipos de proceso.	B3 B4	C21	D9
Establecer os parámetros da simulación de procesos químicos baseada en operación unitarias.			D6
Ampliar a habilidade na creación de fojas de cálculo propias y e programación mediante linguaxes de programación e simulacioón para o tratamento e interpretación dos datos experimentais.			D17
Reforzar a expresión oral e escrita para a transmisión de conceptos e resultados dun xeito ordeado e clarificador.	B3 B4	C21	D2 D6 D9

Contidos	
Topic	
TEMA 1. Deseño de experimentos aplicado á industria química.	1.1 Introducción ás técnicas de deseño experimental. Fases do deseño: Elección de variables. Efectos principais. Niveis. Restriccións do deseño. Analise de resultados. 1.2 Exemplos de casos prácticos na química industrial.
TEMA 2. Resolución de casos prácticos mediante ferramentas informáticas	2.1. Emprego de softwares (Python, Matlab ou similares) para o tratamento e interpretación de datos experimentais. 2.2. Emprego de linguaxes de programación (Python ou similares) para o cálculo de parámetros termodinámicos, cinéticos e de transferencia de masa/enerxía en sistemas de interese na industria química.
TEMA 3. Experimentación orientada ao deseño de unidades operativas básicas e á obtención de productos	3.1. Separación/ purificación de mesturas multicompoñentes. 3.2. Extracción de principios activos de matrices sólidas. 3.3. Síntese de productos por vía química. 3.4. Obtención de productos a partir de materias primas residuais. 3.5. Deseño experimental de procesos que impliquen varias operacións unitarias, con e sen reacción química.

Planificación	Class hours	Hours outside the classroom	Total hours
Lección maxistral	7.5	15	22.5
Estudo de casos	12	18	30
Prácticas de laboratorio	24	36	60
Traballo tutelado	6	14	20
Resolución de problemas e/ou exercicios	0	14	14
Exame de preguntas obxectivas	0	3.5	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 na clase dos conceptos e procedimentos craves para a aprendizaxe dos contidos do temario
Estudo de casos	Actividade consistente na análise de situacións reais relacionadas coa experimentación na Enxeñería Química
Prácticas de laboratorio	Realización das experiencias de laboratorio que figuran nos contidos.
Traballo tutelado	Proxecto experimental realizado polo estudiante, de maneira individual ou en grupo, no cal poña en práctica os coñecementos adquiridos na materia

Atención personalizada	
Methodologies	**Description**
Prácticas de laboratorio	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Lección maxistral	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Estudo de casos	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).
Traballo tutelado	Atención para a resolución de dúbidas e seguimento do traballo diario do/o alumno/a. Esta actividade tamén pode ser levada a cabo de forma non presencial (a través do correo electrónico ou do campus virtual).

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Considerarase a asistencia, a actitude, a participación e a calidade do traballo realizado no laboratorio. Os informes deberán ser entregados individualmente na semán seguinte á realización da práctica, e sempre antes de realizar unha nova sesión de laboratorio. Considéranse varios formatos diferentes de presentar os resultados das prácticas: Memora de prácticas, presentación de PowerPoint, póster, artigo de investigación, video, etc. Cada informe, en calquera dos formatos, debe conter unha explicación do traballo feito no laboratorio, os datos obtidos e a súa análise, e as conclusións derivadas deles. Ademáis, tamén débese inclui-lo obxetivo da práctica e, no seu caso, os fundamentos teóricos aplicados. Baixo ninguna circunstancia se avaliará o informe presentado por un/unha alumno/a que non fixera antes a práctica no laboratorio. As competencias CG3, CG4, CT6, CT9 e CE21 avalíaranse en base ás entregas do alumno/a ó rematar cada unha das prácticas, dependendo do formato, por rúbrica. A competencia CT17 avalíase en base ó traballo realizado no laboratorio, onde as prácticas realízanse en grupos de 2 alumnos.	30	B3 B4	C21	D6 D9 D17
Traballo tutelado	Cada alumno/a deberá facer un proxecto individual ou en grupo (dacordo cos profesores) e entrega-lo, polo menos 15 días antes de rematar as clases, no formato de memorándum. Este proxecto terá por obxecto o deseño dun experimento real que combine varias das técnicas estudadas nas sesións de prácticas, a execución do mesmo, a análise e presentación dos resultados obtidos, e a elaboración dun documento escrito que sirva de "guión" nun futuro. O proxecto realizado tamén deberá expoñerse públicamente, ante un tribunal ou en actividades programadas con iste fin, antes do inicio do periodo oficial de exames. A data da exposición publicarase ao inicio da materia. En ningún caso, se avaliará o proxecto presentado por un/unha alumno/a que non participase en tódalas fases da súa elaboración, incluida a súa exposición pública. Avalíanse as competencias CG3, CG4, CE21, CT10 coa proposta feita para resolve-lo problema experimental plantexado. As competencias CT2, CT6, CT9 e CT10 avalíanse en función da calidade do traballo realizado no laboratorio e do informe elaborado ao remate da proba. Valorarase a redacción, estructura e presentación dos mesmos, a análise e tratamento de datos feito, así como as conclusións acadadas. A competencia CT17 avalíase a partir do traballo feito nas fases de escolla, deseño, execución e exposición pública, pois en todas elas o alumnado traballa en equipos de 2 alumnos.	30	B3 B4	C21	D2 D6 D9 D10 D17

Resolución de problemas e/ou exercicios	Exercicios que se fagan e entreguen ao profesor ó longo do curso, en relación cos contidos da materia vistos nas clases de teoría. Ó longo do curso cada alumno/a deberá entregar varios exercicios resoltos, que nalghun caso serán exercicios resoltos no mesmo aula e, noutros casos, serán exercicios que deberá resolver de forma autónoma. As competencias CG3 e CG4 avalíanse en función da resolución dos problemas plantexados, para o cal o alumno deberá aplicar os coñecementos específicos desta materia xunto con coñecementos de materias básicas cursadas con anterioridade. As competencias CT2, CT6, CT9, CT10 e CE21 avalíaranse coa resolución, por parte do/a alumno/a, de problemas relacionados co temario. Neste caso, ademais de saber aplicar coñecementos, tamén deberá demostrar a súa capacidade para resolver problemas de maneira autónoma empregando ferramentas informáticas	10	B3 B4	C21	D2 D6 D9 D10
Exame de preguntas obxectivas	A proba final de avaliación farase ao final do período de clases, na data fixada polo centro. A proba, que é de carácter teórico-práctico, consistirá na resolución de problemas curtos e/ou casos prácticos valéndose de ferramentas informáticas. Nela avaliarase a asimilación por parte do alumno dos conceptos teóricos e prácticos desenvolvidos na materia. As competencias CG3, CG4 e CE21 avalíanse no exame de teoría, en función das respostas do alumno ás preguntas plantexadas. As competencias CE21, CT2, CT6 e CT9 avaliaranse no exame de problemas, en base á resolución de varios problemas de Enxeñaría Química, para o que terá que aplicar coñecementos adquiridos na aula. A competencia CT10 avaliarase en ámbalas duas partes, xa que os dous exames esixen a capacidade de análise e síntese. Ademais, nos dous casos, o resultado obtido é unha medida do traballo autónomo feito	30	B3 B4	C21	D2 D6 D9 D10

Other comments on the Evaluation

Criterios a seguir para a cualificación final

PRIMEIRA CONVOCATORIA

1. Estudantes que seguen a avaliación continua

Considerarase que un/unha estudante cursa a materia en ***réxime de avaliación continua***, sempre e cando non renunciara oficialmente á avaliación continua, é decir, sempre que non solicitara a "renuncia á avaliación continua", nos prazos fixados pola dirección da E.E.I. a tal fin.

A cualificación final dos/as estudantes que cursen a materia en réxime de avaliación continua farase dacordo aos seguintes criterios:

(a) *Obrigatoriedade de facer e aproba-lo* "Exame de preguntas obxectivas", as "Prácticas de laboratorio"e o "Traballo tutelado":

- NON aprobará a materia quen non faga e aprobe estas tres probas (exame de preguntas obxectivas, prácticas de laboratorio e traballo tutelado).
- Tódalas probas avaliaranse sobre un máximo de 10 puntos, de xeito que para aproba-las o/a estudante terá que acadar unha cualificación ≥ 5 puntos. No caso de non alcanzar nalgunha das probas indicadas anteriormente unha nota ≥ 5 puntos, a calificación final máxima non poderá superar os 4,9 puntos.

(b) *O/A estudante que cumpra a condición dada no apartado (a)* aprobará a materia a condición de que a suma das cualificacións obtidas en tódalas probas de avaliación recollidas nesta guía sexa ≥ 5 puntos.

2. Estudantes con renuncia oficial á avaliación continua

Aqueles estudantes aos que a Dirección da E.E.I. lles conceda a "renuncia á avaliación continua" terán que facer e aprobar un exame final consistente en:

i) Resolución de problemas curtos (30% da nota total)

ii) Cuestións sobre fundamentos teóricos da experimentación (10% da nota total)

iii) Cuestións relacionadas coa experimentación no laboratorio (60% danota total).

SEGUNDA CONVOCATORIA

Para os/as estudantes que cursaron a materia en ***réxime de avaliación continua***: Manterase a cualificación da proba "Resolución de problemas e/ou exercicios" e o/a alumno/a deberá repetir aquelas outras probas nas que, na primeira convocatoria, non acadou a nota mínima esixida.

Para o estudiantado que ***renuncie oficialmente á avaliación continua***: Rexen os mesmos criterios que na primeira convocatoria.

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

Himmelblau y Bischoff, **Análisis y simulación de procesos**, Reverté, 2004

Baum, E. J., **Chemical Properties Estimation: Theory and Application**, CRC Press, 2018

Turton, R., **Analysis, synthesis and design of chemical processes**, 5, Pearson Education, 2018

MacCabe W.L., Smith J., **Unit Operations of Chemical Engineering**, 9, MacGraw Hill, 2005

Richard M. Felder and Ronald W. Rousseau, **Elementary Principles of Chemical Processes**, 4, McGraw-Hill, 2015

Complementary Bibliography

Gintaras V. Reklaitis, **Introduction to Material and Energy Balances**, 1, Wiley, 1983

Recomendacións

Subjects that continue the syllabus

Simulación e optimización de procesos químicos/V12G350V01702

Subjects that are recommended to be taken simultaneously

Control e instrumentación de procesos químicos/V12G350V01603
Reactores e biotecnoloxía/V12G350V01601

Subjects that it is recommended to have taken before

Enxeñaría química I/V12G350V01405
Termodinámica e transmisión de calor/V12G350V01301
Experimentación en química industrial I/V12G350V01505
Enxeñaría química II/V12G350V01503

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.

IDENTIFYING DATA				
Control e instrumentación de procesos químicos				
Subject	Control e instrumentación de procesos químicos			
Code	V12G350V01603			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	3	2c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Orge Álvarez, Beatriz Prudencia			
Lecturers	Orge Álvarez, Beatriz Prudencia			
E-mail	orge@uvigo.es			
Web				
General description				

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C22	CE22 Capacidade para deseñar, xestionar e operar procedementos de simulación, control e instrumentación de procesos químicos.
D2	CT2 Resolución de problemas.
D5	CT5 Xestión da información.
D6	CT6 Aplicación da informática no ámbito de estudo.
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		
Elaborar procedementos de calibración e calcular incertezas de variables de proceso.	B3 B4	C22	D6 D9
Seleccionar a instrumentación máis adecuada nun proceso.	B3 B4	C22	D5 D9
Realizar a xestión integral da información de variables de proceso.	B3 B4	C22	D2 D5 D6 D9 D10
Deseñar sistemas de captura de variables de proceso e *interfaz de operador.	B3 B4	C22	D5 D6 D9 D10 D17
Simular o comportamento dinámico de equipos de proceso.	B3 B4	C22	D6 D9
Axustar *algoritmos de control de equipos e procesos *batch e continuos.	B3 B4	C22	D2 D6 D9

Contidos
Topic

Calibración de variables de procesos químicos e diagramas P&ID. Muestreo, captura e análise de variables de proceso.	Introdución. Instrumentación de procesos químicos: Variables. Analizadores de proceso en liña. Muestreo. Calibrado de medidores (ej. pH). Diagramas P&ID.
Modelado dinámico de procesos químicos.	Modelado dinámico de procesos químicos: Linealidad. Ecuacións dinámicas para a formulación de modelos de parámetros globalizados e parámetros distribuídos na Industria Química (Transporte, estado, equilibrio químico e de fases, cinética química, etc.). Representación. Modelado dinámico tanques de mestura, precalefactores, reactores, CSTR isotermo e non isotermo, etc. Dinámica de procesos químicos: Dominio do tempo, dominio de Laplace e dominio da frecuencia. Aplicación a CSTR, reactor batch, etc.
Criterios, restricciones e deseño de algoritmos de control de procesos batch e continuos. Métodos experimentais de determinación de algoritmos de control.	Control feedback. Axuste de PID de procesos químicos. Estimadores e Predictores. Identificación de procesos químicos.
Resolución de casos prácticos de control.	-Monitorización de as variables de un proceso químico mediante software especializado. -Control de procesos de a industria química e de proceso: Selección de variables. Modelado, axuste de o algoritmo de control e simulación en Simulink.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	29	52.2	81.2
Estudo de casos	24	43.2	67.2
Resolución de problemas	23	50.6	73.6
Exame de preguntas de desenvolvemento	3	0	3

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

Metodoloxía docente

	Description
Lección maxistral	Exposición en clase dos conceptos e procedementos craves para a aprendizaxe do contido do temario.
Estudo de casos	Resolución de casos prácticos e exercicios de aplicación dos coñecementos relacionados coa materia coa axuda do profesor e de forma autónoma.
Resolución de problemas	Resolución de exemplos e exercicios ilustrativos da materia impartida nas sesións maxistrais.

Atención personalizada

Methodologies	Description
Estudo de casos	Atención para a resolución de dúbidas e seguimiento de o traballo diario de o alumno.
Resolución de problemas	Atención para a resolución de dúbidas e seguimiento de o traballo diario de o alumno.

Avaliación

	Description	Qualification	Training and Learning Results		
Estudo de casos	Resolución por parte de o alumno de casos prácticos de aplicación de os coñecementos adquiridos.	20	B3 B4	C22	D2 D5 D6 D9 D10 D17
Resolución de problemas	Exercicios propostos e proba práctica de os coñecementos adquiridos que comprendan os conceptos e procedementos craves contidos en o temario.	40	B3 B4	C22	D2 D5 D6 D9
Exame de preguntas de desenvolvemento	Exame teórico-práctico que comprenda os conceptos e procedementos craves contidos en o temario.	40	B3 B4	C22	D2 D6 D9

Other comments on the Evaluation

Alumnos con avaliación continua:

-Para poder presentar as memorias dos casos prácticos é necesario asistir polo menos ao 80% das clases prácticas. En caso de non asistir polo menos ao 80 % das clases prácticas a nota desta parte será de 0,0.

1ª convocatoria:

- O exame de preguntas de desenvolvemento valerá o 40% da nota.
- Para superar a materia é necesario que o alumno obteña un mínimo de 2,5 puntos sobre 10 no exame de preguntas de desenvolvemento. En caso de non presentarse ao exame de preguntas de desenvolvemento ou non obter no mesmo polo menos un 2,5 sobre 10, na acta refectirase a cualificación de SUSPENSO, cun valor numérico igual ao 50% da nota de avaliación continua.

2ª convocatoria:

- Na segunda convocatoria conservase a nota do caso práctico (15%) e o exame de preguntas de desenvolvemento valerá o 85% da nota.
- En caso de non presentarse ao exame de preguntas de desenvolvemento na acta refectirase a cualificación de Non Presentado.

Alumnos con renuncia oficial á avaliación continua:

Para aqueles alumnos con renuncia á avaliación continua concedida oficialmente polo centro o exame final incluirá unha parte específica de prácticas e valerá o 100% da nota. Para superar a materia deberá obter polo menos un 10% da nota na parte de 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, 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 acorde á normativa vixente.

Bibliografía. Fontes de información

Basic Bibliography

Ollero de Castro, P., Fernández Camacho, E., **Control e instrumentación de procesos químicos**, 1997

Luyben, **Process modelling simulation and control for chemical engineers**, 1990

Complementary Bibliography

Stephanopoulos, G., **Chemical process control. An introduction to theory and practice**, 2015

Creus, A., **Instrumentación industrial**, 2012

Ozilgen, M., **Food process modelling and control: chemical engineering applications**, 1998

Recomendacións

Subjects that are recommended to be taken simultaneously

Experimentación en química industrial II/V12G350V01602
Reactores e biotecnoloxía/V12G350V01601

Subjects that it is recommended to have taken before

Fundamentos de automática/V12G350V01403
Enxeñaría química I/V12G350V01405
Experimentación en química industrial I/V12G350V01505
Enxeñaría química II/V12G350V01503

Other comments

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

IDENTIFYING DATA				
Technical Office				
Subject	Technical Office			
Code	V12G350V01604			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Alonso Rodríguez, José Antonio			
Lecturers	Alonso Rodríguez, José Antonio González Cespón, José Luis Riol Cañedo, José Carlos 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 Skills for writing, signing and developing projects in the field of industrial engineering, whose purpose, specializing in Industrial Chemistry, construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of: structures, mechanical equipments, energy facilities, electrical systems and electronic installations and industrial plants, and manufacturing processes and automation.
B2	CG2 Ability to manage the activities object of the engineering projects described in CG1.
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 Problems resolution.
D3	CT3 Oral and written proficiency.
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 Apply knowledge.
D10	CT10 Self learning and work.
D11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
D13	CT13 Ability to communicate orally and in writing in the Galician language.
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	
(*)		C18	D3 D5 D6 D9 D10 D17
(*)	B1 B2	C18	D1 D2 D5 D6 D7 D8 D10 D11 D15 D17 D20
(*)	B1 B2		D1 D3 D5 D6 D7 D9 D14 D15 D17
(*)	B2	C18	D1 D2 D3 D5 D6 D7 D8 D9 D11 D13 D14 D16 D17 D20
(*)			D3 D5 D6 D7 D13 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
Profesor de la asignatura, **Apuntes de Oficina Técnica**, Plataforma de teledocencia,, 2017
Complementary Bibliography
Cos Castillo, Manuel de, **Teoría general del proyecto**, Síntesis, 1995
Cos Castillo, Manuel de, **Teoría general del proyecto II**, Síntesis, 1995
Paso a paso con Gantt Project, conectareducacion.educ.ar, 2016
GARCIA-HERAS PINO, ÁLVARO y JULIÁN RODRÍGUEZ FERNÁNDEZ, **Documentación técnica en instalaciones eléctricas**, 2ª, Ediciones Paraninfo S.A., 2017
Comité CTN 157, **PROYECTOS, UNE 157001:2014:Criterios generales para la elaboración formal de los documentos que constituyen un proyecto técnico**, AENOR. ASOCIACION ESPAÑOLA DE NORMALIZACION Y CERT, 2014
GONZÁLEZ, FRANCISCO JAVIER, **Manual para una eficiente dirección de proyectos y obras**, FC Editorial, 2014
ARENAS REINA, JOSE MANUEL, **RÁCTICAS Y PROBLEMAS DE OFICINA TÉCNICA**, LA FABRICA, 2011
MARTÍNEZ GABARRÓN, ANTONIO, **Análisis y desarrollo de proyectos en la ingeniería alimentaria**, ECU, 2011
MONTAÑO LA CRUZ, FERNANDO, **Autocad 2017**, Anaya Multimedia, 2016
MEYERS FRED E., STEPEHENS MATHEW P., **Diseño de instalaciones de manufactura y manejo de materiales, Diseño de instalaciones de manufactura y manejo de materiales**, Prentice Hall, 2006
Tompkins, James A. White John A. Bozer, Yavuz A. Tanchoco J. M. A., **Planeación de instalaciones**, Cengage Learning editores S.A., 2011

Recommendations
Subjects that continue the syllabus
Final Year Dissertation/V12G360V01991

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

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
==========

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				
Optimización de produtos				
Subject	Optimización de produtos			
Code	V12G350V01701			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4	1c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Sánchez Vázquez, Pablo Breogán			
Lecturers	Orge Álvarez, Beatriz Prudencia Sánchez Vázquez, Pablo Breogán			
E-mail	pabsanchez@uvigo.es			
Web				
General description				

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
B8	CG8 Capacidade para aplicar os principios e métodos da calidade.
C20	CE20 Capacidade para a análise, deseño, simulación e optimización de procesos e produtos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
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		
Identificar os puntos críticos e de control nunha planta	B3 B4	C20	D6 D9 D17
Deseñar un sistema de control estadístico de proceso.	B3 B4 B8	C20	D6 D9 D10
Realizar estudos de capacidade do proceso desde o punto de vista da calidade do produto	B3 B4 B8	C20	D2 D6 D9 D17

Contidos	
Topic	
Introdución a o control integral de calidade de materias primas, produtos semielaborados e terminados. Deseño, produción, venda e postventa.	Introdución a o control integral de calidade de materias primas, produtos semielaborados e terminados. Deseño, produción, venda e postventa.
Inspección, aceptación e calidade concertada. Trazabilidad. Control e identificación de puntos críticos das principais industrias químicas e de proceso.	Trazabilidade e puntos críticos de risco asociados a a calidade e variables características de calidade das principais industrias químicas e de proceso. Inspección, aceptación e calidade concertada. Métricas de medida de calidade.
Estudo de capacidade. Gráficos de control SPC, análise e mellora.	Estudo de capacidade. Gráficos de control predictivos, SPC. Análise e toma de decisións de mellora da calidade dos produtos na industria química e de proceso. Deseño de un sistema experto.

Exemplos prácticos de aplicación en industrias químicas e de proceso, orientados ao control de calidade de produtos.	Trazabilidade. Muestreo de aceptación. Determinación da capacidade e gráficos SPC.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	18	34.92	52.92
Estudo de casos	30	62.08	92.08
Resolución de problemas e/ou exercicios	2	0	2
Resolución de problemas e/ou exercicios	3	0	3

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

Metodoloxía docente

	Description
Lección maxistral	Exposición en clase dos conceptos e procedementos craves para a aprendizaxe do contido do temario. Fomentarase a participación activa do alumno
Estudo de casos	Resolución de casos prácticos e exercicios de aplicación dos coñecementos relacionados coa materia coa axuda do profesor e de forma autónoma

Atención personalizada

Methodologies	Description
Estudo de casos	Atención para a resolución de dubidas y seguimento do traballo diario do alumno

Avaliación

	Description	Qualification	Training and Learning Results		
Estudo de casos	Resolución de problemas concretos que describan situacións reais na industria química e de proceso.	20	B3 B4 B8	C20	D2 D6 D9 D10 D17
Resolución de problemas e/ou exercicios	Resolución de cuestións e/ou exercicios teórico-prácticos aplicando os coñecementos adquiridos a realizar na semana 9.	40	B3 B4 B8	C20	D2 D6 D9 D10 D17
Resolución de problemas e/ou exercicios	Resolución de cuestións e/ou exercicios teórico-prácticos aplicando os coñecementos adquiridos a realizar na data fixada polo centro.	40	B3 B4 B8	C20	D2 D6 D9 D10 D17

Other comments on the Evaluation

Alumnos con avaliación continua:

-Aqueles alumnos que obteñan polo menos o 50% da nota da proba práctica que se realizará a metade do cuadrimestre (semana 9) poden optar por liberar esa materia no exame final.
-Na segunda convocatoria non se conserva a nota da primeira proba de avaliación continua.
-Alumnos con renuncia oficial á avaliación continua:
Para aqueles alumnos con renuncia á avaliación continua concedida oficialmente polo centro o exame final incluirá unha parte específica dos casos prácticos e valerá o 100% da nota.
Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será acorde á normativa vixente.

Bibliografía. Fontes de información

Basic Bibliography

D.C. Montgomery, **Control Estadístico de la Calidad**, 2004

Complementary Bibliography

Warren D. Seider, J.D. Seader, D.R. Lewin, **Product and Process Design Principles Synthesis, Analysis, and Evaluation**, 2010
J.M. Juran, **Juran y la Calidad por el Diseño**, 1996
Xie, Ngee, Kuralmani, **Statistical Models and Control Charts for High-Quality Processes [Hardcover]**, 2002
A.J. Gutierrez, **Diseño de Procesos en Ingeniería Química**, 2003

Recomendacións

Subjects that it is recommended to have taken before

Química industrial/V12G350V01504

Other comments

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

IDENTIFYING DATA				
Simulación e optimización de procesos químicos				
Subject	Simulación e optimización de procesos químicos			
Code	V12G350V01702			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4	1c
Teaching language	Galego Inglés			
Department	Enxeñaría química			
Coordinator	Sánchez Bermúdez, Ángel Manuel			
Lecturers	Sánchez Bermúdez, Ángel Manuel			
E-mail	asanchez@uvigo.gal			
Web	http://http://eqea.uvigo.es			
General description	Asignatura obrigatoria que se imparten no 7º cuadrimestre do Grao en Química Industrial, unha vez que o alumno estudou as materias nas que deben demostrar os coñecementos necesarios sobre: - Métodos numéricos empregados na enxeñaría química. - Deseño de reactores químicos. - Deseño de equipos para operacións de separación. - Deseño de equipos de transferencia de calor empregados en procesos químicos. - Control e seguridade dos procesos químicos. Esta materia impártese no último ano. O alumno accede despois de adquirir e desenvolver habilidades para xestionar facilmente as ferramentas informáticas da informática dixital, nas que o uso seguirá funcionando e afondar.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C20	CE20 Capacidade para a análise, deseño, simulación e optimización de procesos e produtos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D8	CT8 Toma de decisións.
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		
Simular un diagrama de fluxo dun proceso en réxime estacionario. Coñecer os métodos mais importantes de simulación de procesos (modular e baseado en ecuacións). Analizar as características estructurais dun proceso químico e determinar o orde de cálculo das unidades, establecer o fluxo de información e seleccionar as variables ou correntes de corte de forma axeitada. Resolver problemas de gran escala modelados por sistemas de ecuacións alxebraicas (sistemas dispersos).	B3 B4	C20	D6 D8 D9 D10 D17
Analizar un proceso, determinar os seus graos de libertade e escoller as mellores variables para a súa optimización. Coñecer os fundamentos básicos dos algoritmos mais importantes de optimización determinista, tanto en variable continua como discreta. Modelar axeitadamente un problema de optimización e/ou síntese de procesos e utilizar as ferramentas axeitadas para resolverlo.	B3 B4	C20	D6 D9 D17
Coñecer os fundamentos básicos do deseño de procesos mediante simuladores de proceso. A descomposición xerárquica e os fundamentos do deseño baseado en superestructuras. Aplicar os conceptos de integración de enerxía para o deseño de redes de intercambio de calor. Saber adquirir y utilizar información bibliográfica y técnica referida a esta materia. Coñecemento e aplicación da terminología inglesa empregada para descreber os conceptos correspondientes a esta materia.	B3 B4	C20	D2 D6 D9 D10

Contidos	
Topic	
BLOCK 1: SIMULACIÓN	TEMA 1. SIMULACIÓN DE PROCESOS. DIAGRAMAS DE FLUXO. Simulacións por computador. Tipos de simuladores. Optimización. TEMA 2. SIMULACIÓN SECUENCIAL MODULAR. Descomposición de sistemas a gran escala. Algoritmos de particionamento. Descomposición de Redes Cíclicas Máximas. TEMA 3. SIMULACIÓN ORIENTADA A ECUACIÓNS. Método de factorización local (criterio de Markowitz). Reordenación "a priori" de matrices dispersas. Fase numérica. TEMA 4. GRAOS DE LIBERDADE DUN DIAGRAMA DE FLUXO. Graos de liberdade. Solución de ecuacións Sistemas de ecuacións non lineais. Selección das variables de deseño. TEMA 5. PROPIEDADES FÍSICAS EN SIMULADORES DE PROCESOS QUÍMICOS. Obtención e uso de propiedades físicas. Uso dos sistemas de cálculo de propiedades físicas. TEMA 6. DESEÑO CONCEPTUAL DE PROCESOS. Síntese xerárquica. Síntese baseada na programación matemática. Exemplos de aplicación: Síntese de redes de cambiadores de calor (método de deseño "pinch"). Extensións do método de "pinch".
BLOQUE 2: OPTIMIZACIÓN	TEMA 7. OPTIMIZACIÓN DE PROCESOS QUÍMICOS. Conceptos básicos sobre optimización. Optimización non liñal sin restriccións. Conceptos básicos da optimización non liñal con restriccións (igualdade e desigualdade). TEMA 8. MÉTODOS NUMÉRICOS DE OPTIMIZACIÓN. OPTIMIZACIÓN SIN RESTRICCIÓNS. Optimización multivariable sen restriccións. Método de gradiente. Método de Newton. Métodos da secante. TEMA 9. PROGRAMACIÓN LIÑAL (LP). Definicións e teoremas básicos da programación liñal. Resolución do problema. O algoritmo Simplex. Programación cuadrática. TEMA 10. MÉTODOS NUMÉRICOS PARA A OPTIMIZACIÓN DE PROBLEMAS NON LIÑAIS CON RESTRICCIÓNS. Métodos de penalización, barreira e Lagrangiana aumentada. Programación cuadrática sucesiva. Método do gradiente reducido.
ESTUDO DE CASOS	Exemplos prácticos de aplicación en industrias químicas e de proceso, utilizando software de simulación e optimización de procesos.

Planificación	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	2	8	10
Lección maxistral	6	0	6
Aprendizaxe baseado en proxectos	12	36	48
Estudo de casos	6	0	6
Simulación	0	18	18
Prácticas con apoio das TIC	24	0	24
Resolución de problemas de forma autónoma	0	25	25
Metodoloxías baseadas en investigación	0	10	10
Exame de preguntas de desenvolvemento	0	3	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	Description
Actividades introdutorias	Presentación e introducción ó uso dos programas de simulación e optimización: Matlab, Pyhton-Cantera, COCO SIMULATOR, CHEMPSEP, DWSIM, HYSYS e ASPEN PLUS

Lección maxistral	Presentación verbal organizada de temas referidos ós contidos da asignatura, impartidos polo profesor con axudas visuais. Este método didáctico didáctico, implica a comunicación unidireccional do presentador activo ós estudiantes.
Aprendizaxe baseado en proxectos	Os estudantes traballarán nun proxecto durante un período de tempo prolongado (o cuatrimestre) que os involucre na resolución dun problema do mundo real ou na resposta a unha pregunta complexa. Demostran os seus coñecementos e habilidades creando un produto público ou unha presentación para un público real.
Estudo de casos	Se plantexan escenarios baseados en situacións nas que os alumnos observan, analizan, rexistran, implementan, conclúen, resumen ou recomendan. Os estudos de casos créanse e utilízanse como ferramenta de análise e discusión.
Simulación	O alumno ten que preparar, e documentar, unha simulación que implique un proceso orixinal, a mellora de un proceso documentado ou a optimización dun proceso ou planta existente, así como crear unha presentación pública do seu traballo.
Prácticas con apoio das TIC	Se plantexarán simulacións de parte de procesos ou unidades de operación para resolver coas distintas ferramentas informáticas que se contemplan na materia (simuladores de proceso, linguaxes de programación, etc.).
Resolución de problemas de forma autónoma	Se plantexará a resolución de problemas de libros tradicionais da enxeñaría química que serán resoltos mediante as ferramentas propostas na materia, como alternativa ós métodos tradicionais de resolución.
Metodoloxías baseadas en investigación	O alumno deberá documentar o uso de sistemas de busca bibliográfica asi como de datos de interese na web (fontes de información titoriais, etc.).

Atención personalizada

Methodologies	Description
Simulación	O alumno propondrá unha simulación de un proceso novo, mellora de un existente ou optimización de un proceso ou planta ou, no seu caso, debe adoptar o asignado polo profesor que titorará de xeito individualizado ou por grupo cada unha das simulacións da clase.
Aprendizaxe baseado en proxectos	O profesor propondrá pequenos proxectos que os alumnos han de resolver mediante as ferramentas que se lles indiquen na clase e entragar para a súa puntuación dacordo á rúbrica correspondente que será publicada na plataforma de e-learning. Cada alumno debe entragar o traballo realizado en clase ó finalizar a mesma. Os proxectos recibirán unha puntuación acorde á rúbrica que se publicará na plataforma de e-learning.
Estudo de casos	Se plantexan escenarios baseados en situacións nas que os alumnos observan, analizan, rexistran, implementan, conclúen, resumen ou recomendan. Non haberá probas.
Prácticas con apoio das TIC	Na aula informática ou na aula de teoría se farán simulacións e resolución de problemas mediante ferramentas informáticas que han de ser entregados no memo día polos alumnos. cualificación estará rubricada por rúbrica públicada na plataforma de e-learning.

Avaliación

	Description	Qualification	Training and Learning Results
Aprendizaxe baseado en proxectos	Se realizará durante todo o semestre e se entregará ó concluir as clases presenciais e antes do exame final. A cualificación estará rubricada por rúbrica públicada na plataforma de e-learning.	20	
Simulación	O alumno debe realizae e entregar unha simulación que contribúe á avaliación continua e que debe ser realizada de xeito tutelado durante todo o semestre. A cualificación estará rubricada por rúbrica públicada na plataforma de e-learning.	20	
Resolución de problemas de forma autónoma	Periódicamente o alimno debe entregar resoltos os problemas que se lle plantexan.	20	
Exame de preguntas de desenvolvemento	Correesponde ó exame final da asignatura que, no caso de renuncia á avaliación continua, será o total da nota. Está constituído por un ou varios casos, ou simulacións e a súa correccióne stará asemesmo rubricada.	40	

Other comments on the Evaluation

Alumnos con avaliación continua: A avaliación continua aplicaráse na primeira convocatoria.

Para os alumnos con renuncia concedida oficialmente polo centro á avaliación continua o exame final valerá o 100%.

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o

alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0).

Bibliografía. Fontes de información

Basic Bibliography

Kamal I.M. Al-Malah, **Aspen Plus: Chemical Engineering Applications**, 1st Edition, Wiley, 2016

Juma Haydary, **Chemical Process Design and Simulation: Aspen Plus and Aspen Hysys Applications**, 1st Edition, AIChE, 2019

D.M. Himmelblau, K.B. Bischoff, **Análisis y Simulación de Procesos**, Reverté, 2004

Simant Ranjan Upreti, **PROCESS MODELING AND SIMULATION FOR CHEMICAL ENGINEERS**, 1st Edition, Wiley, 2017

Complementary Bibliography

David. M. Himmelblau, **Optimization of Chemical Processes**, 2nd Edition, McGraw-Hill Higher Education, 2001

Recomendacións

Subjects that continue the syllabus

Control e instrumentación de procesos químicos/V12G350V01603
Deseño de plantas químicas e de proceso/V12G350V01914
Modelaxe de procesos biotecnolóxicos/V12G350V01924

Subjects that are recommended to be taken simultaneously

Xestión e posta en servizo de plantas químicas e de proceso/V12G350V01912
Optimización de produtos/V12G350V01701
Procesos e produtos biotecnolóxicos/V12G350V01922
Química orgánica industrial/V12G350V01923

Subjects that it is recommended to have taken before

Enxeñaría química I/V12G350V01405
Termodinámica e transmisión de calor/V12G350V01301
Experimentación en química industrial I/V12G350V01505
Experimentación en química industrial II/V12G350V01602
Enxeñaría química II/V12G350V01503
Reactores e biotecnoloxía/V12G350V01601
Calor e frío na industria de proceso/V12G350V01913
Técnicas e xestión medioambientais/V12G350V01925

Other comments

Os pilares que sustentan esta materia concrétanse no uso das técnicas de cálculo numérico, aplicado ós contidos proprios da enxeñaría química: balances de materia i enerxía , fenómenos de trasporte, termodinámica, fluidodinámica, termotecnia, operacións de separación, reactores , control de procesos , etc.).

IDENTIFYING DATA				
Compoñentes eléctricos en vehículos				
Subject	Compoñentes eléctricos en vehículos			
Code	V12G350V01902			
Study programme	Grao en Enxeñaría en Química Industrial			
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	
A2	Que os estudantes saiban aplicar os seus coñecementos ó seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo.
A3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.
A5	Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía.
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.
B7	CG7 Capacidade para analizar e valorar o impacto social e ambiental das solucións técnicas.
B10	CG10 Capacidade para traballar nun medio multilingüe e multidisciplinar.
D1	CT1 Análise e síntese.
D3	CT3 Comunicación oral e escrita de coñecementos.
D5	CT5 Xestión da información.
D7	CT7 Capacidade para organizar e planificar.
D8	CT8 Toma de decisións.
D10	CT10 Aprendizaxe e traballo autónomos.
D15	CT15 Obxectivación, identificación e organización.
D16	CT16 Razoamento crítico.
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)	A2 A3 A5	B3 B7 B10	D1 D3 D5 D7 D8 D10 D15 D16 D17

Coñecer as variantes de rede eléctrica de abordo co aumento de tensión.	A2 A3 A5	B3 B7 B10	D1 D3 D5 D7 D8 D10 D15 D16 D17
Coñecer propiedades, funcionamento e compoñentes que proceden de a rede eléctrica de abordo tradicional en vehículos.	A2 A3 A5	B3 B7 B10	D1 D3 D5 D7 D8 D10 D16 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	V12G350V01903			
Study programme	Grado en Ingeniería en Química Industrial			
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,
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Hornby, Albert Sidney, **Oxford Advanced Learner□s Dictionary**, Oxford University Press,
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Complementary Bibliography

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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	V12G350V01904			
Study programme	Grado en Ingeniería en Química Industrial			
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 Apply 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,

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Complementary Bibliography

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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	V12G350V01905			
Study programme	Grado en Ingeniería en Química Industrial			
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 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.
C18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
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 Apply knowledge.
D10	CT10 Self learning and work.
D11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
D13	CT13 Ability to communicate orally and in writing in the Galician language.
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

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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:, **----------**, ----------,

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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:, **----------**, ----------,

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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	V12G350V01906			
Study programme	Grao en Enxeñaría en Química Industrial			
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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química 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 para 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,

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Complementary Bibliography

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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	V12G350V01907			
Study programme	Grao en Enxeñaría en Química Industrial			
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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química 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 necesaria no exercicio da profesión de Enxeñeiro Técnico Industrial. CG11 Conocimiento, comprensión y capacidad para aplicar la legislación necesaria en el ejercicio de la
D2	CT2 Resolución de problemas.
D5	CT5 Xestión da información.
D7	CT7 Capacidade para 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 a semana de 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	V12G350V01908			
Study programme	Grado en Ingeniería en Química Industrial			
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				
Integración da planta na xestión do negocio				
Subject	Integración da planta na xestión do negocio			
Code	V12G350V01911			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4	1c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Orge Álvarez, Beatriz Prudencia			
Lecturers	Orge Álvarez, Beatriz Prudencia			
E-mail	orge@uvigo.es			
Web				
General description				

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C22	CE22 Capacidade para deseñar, xestionar e operar procedementos de simulación, control e instrumentación de procesos químicos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D7	CT7 Capacidade para organizar e planificar.
D8	CT8 Toma de decisións.
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		
Planificar, programar e gestionar operacións e procedementos de sistemas de control de produción de procesos batch e continuos.	B3 B4	C22	D2 D6 D7 D8 D9 D10 D17
Integrar a información de os procesos de a planta química en a xestión de o negocio.	B3 B4	C22	D6 D7 D8 D9 D10
Adquirir habilidades para o traballo en grupo con obxectivos.			D7 D8 D17

Contidos	
Topic	
Técnicas de planificación, programación e xestión de a produción de procesos batch e continuos.	Técnicas de planificación, programación e xestión de a produción de procesos batch e continuos.

Integración de as operacións e procesos de a industria química e de proceso en a xestión de o negocio. Visibilidad e produción colaborativa.	Integración de as operacións e procesos de a planta química en a xestión de o negocio. Visibilidad e produción colaborativa (Collaborative Manufacturing). Xestión e integración de procesos batch, ISA S-88
Modelado de planta para o intercambio de información ERP-Mes. Estándares de integración. Operacións de planta e recursos: persoal, equipamiento, material, enerxía, variables de proceso, lotes, etc.	Modelado de planta para o intercambio de información ERP - MES. Estándares de integración (ISA S-95). Xestión e integración de a enerxía en a planta. Determinación de consumos e emisións específicas.
Proxecto de integración: modelado e implementación de un caso real de unha industria de proceso.	Resolución de casos reais de planificación de produción na industria química e de proceso utilizando ferramentas de software. -Proxecto de integración: modelado e implementación dun caso real dunha industria química ou de proceso.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	20	35	55
Resolución de problemas	20	35	55
Estudo de casos	35	77	112
Exame de preguntas de desenvolvemento	3	0	3

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

Metodoloxía docente

	Description
Lección maxistral	Exposición en clase dos conceptos e procedementos craves para a aprendizaxe do contido do temario.
Resolución de problemas	Resolución de exemplos e exercicios ilustrativos da materia impartida nas sesións magistrales.
Estudo de casos	Resolución de casos prácticos e exercicios de aplicación dos coñecementos relacionados coa materia, coa axuda do profesor e de forma autónoma.

Atención personalizada

Methodologies	Description
Estudo de casos	Atención para a resolución de dúbidas e seguimiento do traballo diario do alumno.
Resolución de problemas	Atención para a resolución de dúbidas e seguimiento do traballo diario do alumno.

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas	Traballos e exercicios propostos polo profesor que comprendan os conceptos e procedementos craves contidos no temario.	20	B3 B4	C22	D2 D6 D7 D8 D9 D10
Estudo de casos	Resolución por parte do alumno de casos prácticos de aplicación dos coñecementos adquiridos e presentación do correspondente informe da actividade realizada.	40	B3 B4	C22	D2 D6 D7 D8 D9 D10 D17
Exame de preguntas de desenvolvemento	Exame teórico-práctico que comprenda os conceptos e procedementos craves.	40	B3 B4	C22	D2 D6 D8 D9

Other comments on the Evaluation

Alumnos con avaliación continua:

-Para poder presentar os estudos de casos é necesario asistir polo menos ao 80% das clases prácticas. En caso de non asistir polo menos ao 80 % das clases prácticas a nota desta parte será de 0,0.

1ª convocatoria:

- O exame de preguntas de desenvolvemento valerá o 40% da nota.
- Para superar a materia é necesario que o alumno obteña un mínimo de 2,5 ptos sobre 10 no exame de preguntas de desenvolvemento. En caso de non presentarse ao exame de preguntas de desenvolvemento ou non obter no mesmo polo menos un 2,5 sobre 10, na acta reflectirase a cualificación de SUSPENSO, cun valor numérico igual ao 50% da nota de avaliación continua.

2ª convocatoria:

- Na segunda convocatoria consérvase a nota do estudo de casos (40%) e o exame de preguntas de desenvolvemento valerá o 60% da nota.
- Para superar a materia é necesario que o alumno obteña un mínimo de 2,5 ptos sobre 10 no exame de preguntas de desenvolvemento.
- Se no exame de preguntas de desenvolvemento non se obtén no mesmo polo menos un 2,5 sobre 10, na acta reflectirase a cualificación de SUSPENSO, cun valor numérico igual ao 50% da nota.
- En caso de non presentarse ao exame de preguntas de desenvolvemento na acta reflectirase a cualificación de Non Presentado.

Alumnos con renuncia oficial á avaliación continua:

Para aqueles alumnos con renuncia á avaliación continua concedida oficialmente polo centro o exame final incluirá unha parte específica dos casos prácticos e valerá o 100% da nota.

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

B. Scholten, **The Road to Integration: A Guide to Applying the ISA-95 Standard in Manufacturing**, 2007

Meyer, Fuchs, Thiel, **Manufacturing Execution Systems (MES): Optimal Design, Planning, and Deployment**, 2009

Li, W.D.; Ong, S.K.; Nee, A.Y.C, **Collaborative Product Design and Manufacturing Methodologies and Applications**, 2007

ANSI/ISA S-95,

ANSI/ISA S-88,

Complementary Bibliography

Recomendacións

Subjects that are recommended to be taken simultaneously

Xestión e posta en servizo de plantas químicas e de proceso/V12G350V01912
Optimización de produtos/V12G350V01701
Simulación e optimización de procesos químicos/V12G350V01702

Subjects that it is recommended to have taken before

Control e instrumentación de procesos químicos/V12G350V01603

Other comments

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

IDENTIFYING DATA				
Xestión e posta en servizo de plantas químicas e de proceso				
Subject	Xestión e posta en servizo de plantas químicas e de proceso			
Code	V12G350V01912			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4	1c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Orge Álvarez, Beatriz Prudencia			
Lecturers	Orge Álvarez, Beatriz Prudencia			
E-mail	orge@uvigo.es			
Web				
General description				

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C20	CE20 Capacidade para a análise, deseño, simulación e optimización de procesos e produtos.
D2	CT2 Resolución de problemas.
D7	CT7 Capacidade para organizar e planificar.
D8	CT8 Toma de decisións.
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		
Manexar fontes de información e documentación en Enxeñaría química.			D7 D10 D17
Estimar as capacidades e os custos de equipamentos e instalacións de plantas químicas e de proceso.	B3 B4	C20	D2 D9 D10 D17
Estimar os custos das operacións de planta tanto en procesos continuos como *batch.	B3 B4	C20	D2 D9 D10 D17
Coñecer e aplicar os principios básicos da *reingeniería de procesos a unha planta xa existente.	B3 B4	C20	D2 D7 D8 D9 D10
Aplicar criterios económicos de deseño e estimar os riscos en plantas de proceso.	B3 B4	C20	D7 D8 D9 D10

Contidos
Topic

Estratexia da investigación industrial e desenvolvemento de procesos na industria química e de proceso.	Fontes de información e documentación en Ingeniería Química. Estratexia da investigación industrial e desenvolvemento de procesos na industria química e de proceso.
Localización e dimensionamento da planta. Estimación de capacidade e de custos de equipos e procesos. Custos de produción, operación e xerais. Índices de custos de planta. Posta en servizo e operación de plantas.	Localización e dimensionamento da planta. Estimación de capacidade e de custos de equipos e procesos. Custos de produción, operación e xerais. Índices de custos de planta. Posta en servizo e operación de plantas. Xestión e modelado de industrias de proceso de produción flexible multiproducto
Optimización e criterios económicos de deseño baseados na sostenibilidad. Variables de deseño Rentabilidad e Risco. Criterios estáticos e dinámicos.	Optimización e criterios económicos de deseño baseados na sostenibilidad. Variables de deseño Rentabilidad e Risco. Criterios estáticos e dinámicos.
Reingeniería de procesos (BPR).	Reingeniería de procesos (BPR).
Resolución de casos reais aplicados a industria química e de proceso.	Resolución de casos reais aplicados a industria química e de proceso.

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	20	35	55
Resolución de problemas	20	35	55
Estudo de casos	35	77	112
Exame de preguntas de desenvolvemento	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente

	Description
Lección maxistral	Exposición en clase dos conceptos y procedementos craves para o aprendizaxe do contido do temario. Se fomentará a participación activa do alumno.
Resolución de problemas	Resolución de exemplos e exercicios ilustrativos da materia impartida nas sesións maxistrais.
Estudo de casos	Resolución de casos prácticos e exercicios de aplicación dos coñecementos relacionados coa materia, coa axuda do profesor e de forma autónoma.

Atención personalizada

Methodologies	Description
Estudo de casos	Atención para a resolución de dúbidas e seguimiento do traballo diario de o alumno.
Resolución de problemas	Atención para a resolución de dúbidas e seguimiento do traballo diario de o alumno.

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas	Traballos e exercicios propostos polo profesor que comprendan os conceptos e procedementos craves contidos no temario.	20	B3 B4	C20	D2 D7 D8 D9 D10
Estudo de casos	Resolución por parte do alumno de casos prácticos de aplicación dos coñecementos adquiridos e proba práctica a realizar cara a mediados do cuatrimestre.	40	B3 B4	C20	D2 D7 D8 D9 D10 D17
Exame de preguntas de desenvolvemento	Exame teórico-práctico que comprenda os conceptos e procedementos craves.	40	B3 B4	C20	D2 D8 D9

Other comments on the Evaluation

Alumnos con avaliación continua:

-Para poder presentar os estudos de casos é necesario asistir polo menos ao 80% das clases prácticas. En caso de non asistir polo menos ao 80 % das clases prácticas a nota desta parte será de 0,0.

1ª convocatoria:

- O exame de preguntas de desenvolvemento valerá o 40% da nota.
- Para superar a materia é necesario que o alumno obteña un mínimo de 2,5 ptos sobre 10 no exame de preguntas de desenvolvemento.
- En caso de non presentarse ao exame de preguntas de desenvolvemento ou non obter no mesmo polo menos un 2,5 sobre 10, na acta reflectirase a cualificación de SUSPENSO, cun valor numérico igual ao 50% da nota.

2ª convocatoria:

- Na segunda convocatoria consérvase a nota da resolución de problemas (20%) e o exame de preguntas de desenvolvemento valerá o 80% da nota.
- En caso de non presentarse ao exame de preguntas de desenvolvemento na acta reflectirase a cualificación de Non Presentado.

Alumnos con renuncia oficial á avaliación continua:

Para aqueles alumnos con renuncia á avaliación continua concedida oficialmente polo centro o exame final valerá o 100% da nota.

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

A.J. Gutierrez, **Diseño de Procesos en Ingeniería Química**, 2003

Happel, Jordan, **Economía de los Procesos Químicos**, 1981

Complementary Bibliography

E. Himmelblau, Lasdon, **Optimization of Chemical Process**, 2001

A.Vian, **El Pronóstico Económico en Química Industrial**, 1975

A.B.Badiru, **Project Management in Manufacturing and High Technology Operations**, 1988

Christine Paszko, Elizabeth Turner, **Laboratory Information Management Systems**, 2002

L. Cabra Dueñas; A. de Lucas, **Metodologías del Diseño y Gestión de Proyectos para Ingenieros Químicos**, 2010

Recomendacións

Subjects that are recommended to be taken simultaneously

Optimización de produtos/V12G350V01701
Simulación e optimización de procesos químicos/V12G350V01702

Other comments

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

IDENTIFYING DATA				
Heating and cooling in the process industry				
Subject	Heating and cooling in the process industry			
Code	V12G350V01913			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Míguez Tabarés, José Luis			
Lecturers	Míguez Tabarés, José Luis			
E-mail	jmiguez@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The main objective is that the students acquire the basic knowledge related to the heat exchanges that take place in the different equipment and installations, such as the heat exchangers, boilers, heat pumps, etc. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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 necessary legislation in the exercise of the profession of Industrial Technical Engineer.
D2	CT2 Problems resolution.
D7	CT7 Ability to organize and plan.
D9	CT9 Apply 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	
New	B4	D2
	B5	D7
	B6	D9
	B7	D10
	B11	D17
		D20
New	B4	D2
	B5	D7
	B6	D9
	B7	D10
	B11	D17
		D20
New	B4	D2
	B5	D7
	B6	D10
	B7	D17
	B11	D20
New	B4	D2
	B5	D7
	B6	D9
	B7	D10
	B11	D17
		D20

Contents	
Topic	
Transmission of Heat	Heat exchangers . - Analysis of heat exchangers. - Method NTU - Types of exchangers. Boiling and condensation
Thermal engineering.	Processes of combustion. Burners. Boilers Ovens and dryers. Isolations.
Refrigeration technology	Refrigeration machine and Heat pump. Coefficients of efficiency. Vapor compression refrigeration cycles. Devices for the production of cold. Refrigerants Cryogenics.
Energetic efficiency	Application of the renewable energies (solar thermal, geothermal, biomass,...) as an energy source in the process industry.
-- Practical of laboratory and with support of the TIC	- Determination of the enthalpy of combustion. - Calculation of a deposit of LPG. - Study of the propagation of flame. - Higrometric study of the air. - Study of the heat exchangers. - Energetic balance of a boiler. - Visit to a boilers room.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	22	22	44
Laboratory practical	12	10	22
Problem solving	14	26	40
Mentored work	0	10	10
Practices through ICT	4	4	8
Field practice	4	0	4
Objective questions exam	1	10	11
Objective questions exam	1	10	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	Explanation in blackboard supported with presentation in transparencies, videos and any material that the teacher consider useful to do comprehensible the syllabus of the subject.
Laboratory practical	Practices of laboratory applied.
Problem solving	Resolution of exercises and necessary practical cases to comprise the concepts seen in the classes of theory.
Mentored work	Execution of works individual and/or in group. Inside this activity includes the presentation of works in front of the group and his back evaluation.
Practices through ICT	Resolution of exercises by means of the support of computer programs.
Field practice	Visits are made to real thermal installationsto learn about energy efficiency, environmental and safety aspects of engineering practice. In some cases, they will have to carry out a prior bibliographic search of the mandatory regulations. This action is completed with a brief questionnaire on notions of industrial health and safety.

Personalized assistance	
Methodologies	**Description**
Lecturing	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.
Laboratory practical	The professor will attend the doubts of the students so much in the laboratory as in the schedule of tutorial.
Problem solving	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.
Practices through ICT	The professor will attend the doubts of the students so much in the computer classroom as in the schedule of tutorial.

Mentored work	The professor will attend the doubts of the students so much in the classroom as in the schedule of tutorial.

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	Classical master explanation on whiteboard supported by presentation on transparencies, videos and any material that the teacher considers useful to make the syllabus of the subject.	15	B4 B5 B6 B7	D2 D9 D10
Problem solving	Realization of applied laboratory practices	25	B4 B5 B6 B7	D2 D9 D10
Mentored work	Preparation of a memory and presentation of the work proposed, individually or in group, on the thematic proposal to the start of course.	20	B4 B5 B6 B7 B11	D7 D9 D10 D17 D20
Objective questions exam	Objective proof (1) consisting of short questions or multiple choice to know the progressive evolution of the students during the development of the matter.	20	B4 B5 B6 B7 B11	D7 D9
Objective questions exam	Objective proof (2) consisting of short questions or multiple choice to know the progressive evolution of the students during the development of the matter.	20	B4 B5 B6 B7 B11	D7 D9

Other comments on the Evaluation

The final examination will be composed by a theory part (15%) and a problem part (25%) and it will be mandatory to obtain a minimum mark of 3,5 out of10 between both tests. The continous evaluation (EC) will be evaluated by the work (W) and by 2 objective tests (PO); those who have officially renounced the EC will have had to take a specific questionnaire (CE) at the first opportunity of the course announcement.
The continuous evaluation (EC, 40%) will be evaluated through the work and of objective proofs; those that have renounced officially to the EC will have to make a specific questionnaire (SQ) at the earliest opportunity of the course call.In the second opportunity (July call), the students that have made the EC will be able to choose between keeping the EC mark or make the SQ of the second opportunity.

The End of Degree call will be fully evaluated by means of an exam (100%), that is, the EC of the previous course will not be taken into account.

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

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

Incropera, F.P. et al, **Principles of heat and mass transfer**, 7th ed., international student version, 2013
Múñoz Domínguez, M.; Rovira de Antonio, A.J., **Ingeniería Térmica**, 2006

Complementary Bibliography

Moran, Michael J.; Shapiro, Howard N., **Fundamentos de termodinámica técnica**, 2ª ed., 2004
Rey Martínez F.J.; Velasco Gómez E., **Bombas de calor y energías renovables en edificios**, 2005
Torrella Alcaraz, Enrique, **Frío industrial : métodos de producción**, 2010
Kohan, Anthony L., **Manual de calderas**, 2000

Kreith, Frank, **The CRC handbook of thermal engineering**, 2000

Recommendations

Subjects that it is recommended to have taken before

(*)Física: Física I/V12G350V01102
(*)Física: Física II/V12G350V01202
Chemistry: Chemistry/V12G350V01205
Thermodynamics and heat transfer/V12G350V01301

Other comments

To enrol in this matter is necessary to have surpassed or enrol of all the subjects of the inferior courses.

IDENTIFYING DATA				
Deseño de plantas químicas e de proceso				
Subject	Deseño de plantas químicas e de proceso			
Code	V12G350V01914			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4	2c
Teaching language	Castelán Galego			
Department	Deseño na enxeñaría			
Coordinator	González Cespón, José Luis			
Lecturers	González Cespón, José Luis Lamosa Quinteiro, Martín			
E-mail	epi@uvigo.es			
Web				
General description	A materia de Deseño de Plantas Químicas e de Proceso ten como visión e como misión proporcionar ao futuro Graduado en Enxeñaría en Química Industrial os coñecementos, capacidades e habilidades que lle permitan deseñar, avaliar e implantar plantas de procesado no ámbito da enxeñaría química. É unha materia de natureza interdisciplinar porque require de coñecementos previos sobre procesos e tecnoloxías de transformación de produtos, construcións e instalacións industriais; así como sobre metodoloxías de elaboración, organización e xestión de proxectos, entre outros. O estudo da materia é unha ferramenta fundamental para afianzar os coñecementos adquiridos polo alumnado durante o estudo da carreira, desde os aspectos fundamentais de química física, matemáticas, expresión gráfica, nos cales descansan as aplicacións de enxeñaría química, ata a *implementación dos mesmos na elaboración de proxectos de procesos e plantas de proceso. Para logralo emprégase un enfoque amplo dos contidos da materia, buscando a integración dos coñecementos adquiridos ao longo da carreira, mediante a *implementación de metodoloxías de aprendizaxe activas para que os contidos expostos en clases teóricas aplíquense no desenvolvemento das actividades prácticas, orientadas á realidade industrial da profesión, asimilando o emprego áxil e preciso da distinta normativa de aplicación e das boas prácticas profesionais establecidas, apoiándose nas novas tecnoloxías para documentar, elaborar, xestionar o deseño de procesos e plantas de proceso no ámbito profesional da enxeñaría química.			

Resultados de Formación e Aprendizaxe	
Code	
B1	CG1 Capacidade para a redacción, sinatura 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.
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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química 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.
C18	CE18 Coñecementos e capacidades para organizar e xestionar proxectos. Coñecer a estrutura organizativa e as funcións dunha oficina de proxectos.
D2	CT2 Resolución de problemas.
D7	CT7 Capacidade para organizar e planificar.
D8	CT8 Toma de decisións.
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

Comprender os aspectos básicos de formulación xeral que supón a implantación dun proceso.	B1 B3		
Coñecer e interpretar a diferente normativa de obrigado cumprimento existente referente á actividade.	B6		D8 D20
Desenvolver documentos que expresen a idea de deseño concibida	B1 B4 B5		D2 D7 D8 D14 D17
Habilidade para o traballo en grupo con obxectivos.	B4		D8 D14 D17
Adquirir habilidades para xestionar a información relativa ás plantas de proceso	B4 B6		D2 D7 D8 D10 D14 D17 D20
Capacidade para o deseño de instalacións e sistemas auxiliares na industria química e de proceso.	B1 B4 B5 B6	C18	D2 D7 D8 D10 D14 D17 D20

Contidos	
Topic	
Introdución e presentación da materia.	Presentación. Guía docente da materia. Criterios e normas para o desenvolvemento da materia.
Instalacións de iluminación	Luz: concepto, onda electromagnética, resonancia. Percepción da luz. Fisiología do ollo. Absorción e reflexión. Xeración da cor: RGB e CMYK. Unidades luminosas: lumen e lux. Iluminación. Curvas fotométricas. Niveis de luz. UNE 12464. Calculo do numero de fontes e luminarias. Aplicacións de cálculo: DIALUX ou INDALUX. Eficiencia energética.
Instalacións eléctricas	Repaso de conceptos básicos: intensidade, impedancia e voltaje. Tensión monofásica e trifásica. Diferenzas e aplicación. Conexións de fornezo. Elementos dunha instalación eléctrica. Protección magnetotérmica e diferencial. Neutro e toma de terra. Automatización de instalacións, Contactores. Accionamiento por lóxica eléctrica ou microcontrolador. Deseño dunha instalación eléctrica. Dimensionamiento. Linea de forza e linea de alumado. Reglamento Electrotécnico de Baixa Tensión.
Ventilación	Ventilación Conceptos de ventilación. Calidade de aire. Efecto invernadero. Humidade do aire. Sicrometría. Conductos de aire. Versión consolidada do Real Decreto 1027/2007.
Fontanería e saneamiento	A auga. Caudales de auga e presións. Compoñentes dunha instalación. Tuberías de distribución. Montaxes. Auga quente. Tuberías de evacuación. Probas reglamentarias.
Ruído industrial	Ruído industrial Concepto de ruído. Ondas. Parámetros. Presión e potencia acústica, dB e dBA. Fisiología do oído. Reverberación. Tempo de reverberación T60 e T30. Absorción. Coeficiente de absorción e materiais. Lei de Sabine. Absorción en grandes volumes. Illamento. Concepto de enerxía. Lei de masas. Frecuencias de coincidencia e resonancia. Curvas de illamento. Control do ruído nunha industria. Propagación do son fonte-transmisión-recepción. Enfermidades laborais e relación cos medicamentos. Equipos de protección individual.
Reglamento APQ	Real Decreto 656/2017
Aire comprimido	Aire. Parámetros do aire. Equipos de compresión. Real Decreto 2060/2008

Planificación			
	Class hours	Hours outside the classroom	Total hours
Actividades introdutorias	2	1	3

Lección maxistral	18	27	45
Resolución de problemas	12	12	24
Aprendizaxe baseado en proxectos	18	60	78
Traballo	2	0	2
Resolución de problemas e/ou exercicios	2	0	2
Traballo	2	0	2
Traballo	2	0	2

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

Metodoloxía docente

	Description
Actividades introdutorias	Presentásese a materia, información dos contidos da mesma, metodoloxías que se van a aplicar, traballos a realizar na asignatura e forma de avaliación. Así mesmo realizásense dinámicas na clase para fomentar a interrelación no alunado.
Lección maxistral	Clase maxistral participativa onde se exporán os obxectivos e os principais contidos do temario e poranse a disposición dos alumnos todos aqueles materiais necesarios para o desenvolvemento das actividades prácticas programadas.
Resolución de problemas	O alumno debe desenvolver as solucións axeitadas ou correctas a os exercicios plantexados que se basean na teoría impartida. Realizásense aplicando fórmulas, algoritmos ou procedementos de transformación dá información dispoñible. Será necesaria a interpretación dos resultados.
Aprendizaxe baseado en proxectos	Realizásese un traballo aplicando a metodoloxía de "Aprendizaxe Baseada en Proxectos- ABP". Realización dun proxecto de ingenieria, traballando cun equipo aberto. Farase fincapé na aplicación de ferramentas e coñecementos de ingeniería industrial para crear solucións de ingeniería para as necesidades reais dunha industria.

Atención personalizada

Methodologies	Description
Aprendizaxe baseado en proxectos	O estudante realizara un proxecto de enxeñería, traballando cun equipo aberto. Farase fincapé na aplicación de ferramentas e coñecementos de enxeñería industrial para crear solucións de ingeniería para as necesidades reais dunha industria. Faranse titorías de grupo co profesor para aclarar dúbidas e para o seguimiento do traballo.

Avaliación

	Description	Qualification	Training and Learning Results		
Traballo	Realización de un trabajo de diseño de la instalación eléctrica de una planta industrial y su iluminación	22	B1 B3 B4 B5	C18	D2 D7 D8 D10 D14 D17 D20
Resolución de problemas e/ou exercicios	Realización de diferentes ejercicios relativos al temario	34	B1 B3 B4 B5 B6	C18	D2 D7 D8 D10 D14 D17 D20
Traballo	Dimensionado y diseño de la ventilación de una instalación industrial	22	B1 B3 B4 B5 B6	C18	D2 D7 D8 D10 D14 D17 D20
Traballo	Determinación del nivel de ruido de una instalación	22	B1 B3 B4 B5 B6	C18	D2 D7 D8 D10 D14 D17 D20

Other comments on the Evaluation

SISTEMA DE AVALIACIÓN:

O sistema de avaliación por defecto é o sistema de avaliación continua. O alumno que desexa aproveitar un sistema de avaliación non continuado deberá solicitalo oficialmente, no tempo e na forma establecidos para iso na E.E.I. Se o estudante non solicita u obtén o veredicto favorable da renuncia á avaliación continua, enténdese que está no sistema de avaliación continua.

O alumno que pretende solicitar a exención de avaliación continua deberá notificarlle o profesor o máis axiña posible. Recoméndase facelo ao comezo do curso ou antes de comezar o ensino.

A avaliación levarase a cabo en función das rúbricas publicadas na plataforma TEMA da materia.

CRITERIOS DE SUPERACIÓN DA MATERIA mediante avaliación continua:

Para aprobar o aluno pola avaliación continua debe satisfacer simultaneamente dúas condicións:

a) obter unha puntuación mínima de 4 das 10 en cada unha das seccións avaliable ou partes sinaladas.

b) obter unha puntuación media, ponderada segundo as porcentaxes indicadas anteriormente, cun mínimo de 5 a 10.

Se unha sección é suspendida, ou o estudante desexa mellorar o grao dunha sección, ter un máximo de dous (2) oportunidades para facelo. Neste caso, aplicarase un coeficiente corrector á cualificación da sección. O prazo para tales correccións será establecido polo profesor.

CRITERIOS DE SUPERACIÓN DA MATERIA mediante avaliación continua:

Os alumnos que opten por renunciar oficialmente á avaliación continua deberán realizar un traballo supervisado polo profesor, consistente nun proxecto industrial ou similar, e unha proba de avaliación. Para obter a cualificación atoparase a media proporcional (teoría do 60% e prácticas do 40%). E é obrigatorio obter unha nota mínima de 4 puntos sobre 10 posibles en cada unha das partes. Para superar a materia, a media mencionada debe ser como mínimo de 5 puntos sobre 10 posibles.

Bibliografía. Fontes de información

Basic Bibliography

España. Ministerio de la Presidencia, **RITE + resumen de normas UNE**, 5ª ed, Ceysa, 1985

Fernando Vila Arroyo (coord.), **El libro blanco de la iluminación**, Comité Español de Iluminación, 2013

Jiménez Alcaide, L.; Rodríguez Pascual, A., **El proyecto de una planta química**, UCOPress, Editorial Universidad de Córdoba, 2016

Perry, R.H.; Green, D.W.; Maloney, JO, **Manual del ingeniero químico**, 7ª ed, McGraw-Hill Interamericana de España S.L., 2001

Rase, F; Barrow, M.H., **Diseño de tuberías para plantas de proceso**, Blume, 2001

Sinnott, R.; Towler, G., **Diseño en ingeniería química**, Reverté, 2012

Lagunas Marqués, Ángel, **Instalaciones eléctricas comerciales e industriales : resolución de casos prácticos**, 7ª ed., act., Paraninfo, 2017

Complementary Bibliography

Recomendacións

Subjects that continue the syllabus

Traballo de Fin de Grao/V12G350V01991

Subjects that it is recommended to have taken before

Ciencia e tecnoloxía dos materiais/V12G350V01305
Fundamentos de sistemas e tecnoloxías de fabricación/V12G350V01304
Enxeñaría química I/V12G350V01405
Mecánica de fluídos/V12G350V01401
Resistencia de materiais/V12G350V01404
Control e instrumentación de procesos químicos/V12G350V01603
Enxeñaría química II/V12G350V01503
Oficina técnica/V12G350V01604
Química industrial/V12G350V01504
Tecnoloxía medioambiental/V12G350V01502

Other comments

Previamente á realización das probas facilitarase normativa, manuais ou calquera outro material que sexa necesario.

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				
Bioelectroquímica				
Subject	Bioelectroquímica			
Code	V12G350V01921			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4	1c
Teaching language	Galego			
Department	Enxeñaría química			
Coordinator	Nóvoa Rodríguez, Ramón			
Lecturers	Diéguez Vázquez, Antonio Nóvoa Rodríguez, Ramón			
E-mail	rnovoa@uvigo.gal			
Web	http://moovi.uvigo.gal/			
General description	(*)Nesta materia preténdese introducir ó alumnado na disciplina de Electroquímica, os seus fundamentos e súas aplicacións, con especial énfase nas aplicacións industriais e biotecnolóxicas.			

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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C16	CE16 Coñecementos básicos e aplicación de tecnoloxías ambientais e sustentabilidade.
C19	CE19 Coñecementos sobre balances de materia e enerxía, biotecnoloxía, transferencia de materia, operacións de separación, enxeñaría da reacción química, deseño de reactores, e valorización e transformación de materias primas e recursos enerxéticos.
D2	CT2 Resolución de problemas.
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		
Coñecer os aspectos básicos das reaccións electroquímicas aplicadas a sistemas biotecnolóxicos	B3 B4	C19	D2 D10 D17
Aplicar os conceptos básicos da bioelectroquímica á eliminación de contaminantes, bioenerxía, biocorrosión, etc.	B4	C16	D9 D17

Contidos	
Topic	
Electrolitos e interfases	Potencial de electrodo Estructura das interfases Cinética electroquímica Transporte de materia
Métodos de estudo	Instrumentación electroquímica Electrodos Métodos de corrente contínua Métodos de corrente alterna
(bio)Sensores	Potenciométricos (incluíndo selectividade encimática). Amperométricos
Electroquímica industrial	Electrolise Síntese Baterías Pilas de combustible (incluíndo as de base biolóxica)
Corrosion	Fundamentos Métodos de protección

Biointerfases	Interfases entre biomoléculas Bioenerxía Biocatálise

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32.5	65	97.5
Prácticas de laboratorio	9	13.5	22.5
Resolución de problemas	9	13.5	22.5
Resolución de problemas e/ou exercicios	2	0	2
Resolución de problemas e/ou exercicios	2	0	2
Informe de prácticas, prácticum e prácticas externas	0.5	3	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 dos contidos da materia con apoio audiovisual
Prácticas de laboratorio	Traballos prácticos sincronizados coa exposición de contidos: técnicas experimentais e casos de aplicación.
Resolución de problemas	Resolución de exescicios que permitan fixa-los conceptos de teoría e afrontar con garantía de aproveitamento o traballo de laboratorio.

Atención personalizada	
Methodologies	**Description**
Resolución de problemas	A resolución de exercicios e as prácticas contarán con asistencia individualizada ó alumnado.
Prácticas de laboratorio	A resolución de exercicios e as prácticas contarán con asistencia individualizada ó alumnado.

Avaliación					
	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Traballo no laboratorio e memoria de actividade	30	B4		D9 D17
Resolución de problemas	Exame de exercicios relacionados coa teoría	30	B4	C16 C19	D2 D9 D10
Resolución de problemas e/ou exercicios	Avaliaranse os conceptos presentados nas leccións maxistrais mediante exame de cuestións curtas	40	B3	C16 C19	D9 D10

Other comments on the Evaluation

Compromiso ético:

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

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 puntos).

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Química: Química/V12G350V01205
Ciencia e tecnoloxía dos materiais/V12G350V01305

Enxeñaría química I/V12G350V01405
Tecnoloxía electrónica/V12G350V01402
Enxeñaría química II/V12G350V01503

Other comments

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

IDENTIFYING DATA				
Biotechnological processes and products				
Subject	Biotechnological processes and products			
Code	V12G350V01922			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Longo González, María Asunción			
Lecturers	Diéguez Vázquez, Antonio Longo González, María Asunción			
E-mail	mlongo@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The use of microorganisms for the transformation of raw materials has been carried out by humans since antiquity, although it is more recent (2nd half of 20th century) the use of biocatalysts (microorganisms, enzymes or other biological systems) in industrial processes. The biotechnology industry can be considered an emerging sector of high economic profitability, which makes it necessary to have the scientific and technological knowledge that allow developing and adapting bioprocesses in the different sectors of application. The subject aims to provide students with a global view on the use of biocatalysts (microorganisms, cells or biomolecules) for the development of biotechnological industrial processes as an alternative to traditional processes. The main unit operations involved in this type of process will be studied, as well as the specific aspects that differentiate them from conventional industrial chemical processes. Given that it is a field in continuous expansion, reference will be made to the most recent advances and trends.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C16	CE16 Basic knowledge and application of environmental technologies and sustainability.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Identification of the basic concepts of biotechnological processes, their products and their sources.	B3 B4	C19	D1 D2 D3 D9 D10
Knowledge and understanding of the biotechnological processes carried out by microorganisms of industrial interest, the stages of transformation and separation of products and the most common equipment used.	B3 B4	C16 C19	D1 D2 D3 D9 D10 D16 D17

Being able to propose biotechnological processes in different areas, through knowledge of methodology, requirements and regulations, considering aspects related to the environment, energy and resources.	B3 B4	C16 C19	D1 D2 D3 D9 D10 D16 D17

Contents	
Topic	
Fundamentals of biotechnological processes: microorganisms, enzymes and other metabolites of industrial interest.	- Introduction to biotechnological processes. Microbiological and biochemical fundamentals, and raw materials used.
Technology of biotechnological processes and products. Design of a biotechnological process. Practical cases.	- Preparation of raw materials. - Reaction stage. Kinetics and operation of bioreactors. - Recovery and purification operations. - Study of commercial biotechnological processes and new trends.
Process intensification, energy integration, environmental and biosafety considerations.	- Energy integration methodologies - Introduction to the assessment of environmental impact of processes. - Biosafety. Best available techniques in the biotechnology industry.

Planning

	Class hours	Hours outside the classroom	Total hours
Case studies	9.5	24.5	34
Laboratory practical	18	18	36
Presentation	2	12	14
Lecturing	15	15	30
Mentored work	3	17	20
Seminars	3	11	14
Essay questions exam	1	0	1
Problem and/or exercise solving	1	0	1

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

Methodologies

	Description
Case studies	Processes of interest will be selected, which are representative of the current trends in the biotechnology sector, and a critical analysis will be carried out, in groups or individually. Short presentations will be made in the classroom, encouraging debate, as much as possible.
Laboratory practical	Laboratory experiments and field practices in companies related to the processes treated throughout the course will be carried out. The students will have the support material necessary for a proper understanding of the experiments to be carried out. A brief final report will be prepared in which the main results and conclusions should be collected.
Presentation	The students will make brief presentations of the cases studied in the classroom, as well as the supervised work. A question time will be included, in which the questions posed must be answered.
Lecturing	The lecturer will present the general aspects of the program in a structured way, with special emphasis on the fundamentals and most important or difficult to understand aspects. The lecturer will provide, through the Tem@ platform, the necessary material for a correct follow-up of the subject. The student will be able to work previously the material handed out by the lecturer and consult the recommended bibliography to complete the information.
Mentored work	The students will develop a smal project on a subject assigned by the lecturer. The work will be carried out in groups, that will deliver a written essay and make a presentation.
Seminars	Proposal and resolution of practical cases related to the subject matter. Complementary activity to the case study.

Personalized assistance

Methodologies	**Description**
Lecturing	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).

Laboratory practical	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Seminars	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Mentored work	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Case studies	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).
Presentation	Academic activity carried out by the lecturer during tutoring hours where students, individually or in small groups, can ask questions about the subject, and receive guidance and additional support. This activity can also be carried out in a remote way (through email or virtual campus).

Assessment

	Description	Qualification	Training and Learning Results
Case studies	The work done during the seminars, case studies and practical classes will be evaluated based on: - assistance - attitude and participation of the students during the sessions - quality of submitted reports	20	B3 C16 D1 B4 C19 D2 D3 D9 D10 D16 D17
Presentation	The students will make a presentation of the supervised work, which will be assessed based on its clarity, rigor and demonstration of the knowledge acquired on the subject.	10	D1 D3 D16 D17
Mentored work	The report presented on the assigned work subject will be evaluated. This report must include some minimum aspects, based on a guide that will be provided to the students.	10	B3 C16 D1 B4 C19 D2 D3 D9 D10 D16 D17
Essay questions exam	Written tests will be carried out, which will include essay questions, for the evaluation of the acquired competences in relation to the contents of the course.	30	B3 C16 D1 B4 C19 D2 D3 D9
Problem and/or exercise solving	Written tests will be carried out, which will include short questions or exercises and problems, for the evaluation of the acquired competences in relation to the contents of the course.	30	B3 C16 D1 B4 C19 D2 D3 D9

Other comments on the Evaluation

1. Considerations on continuous evaluation.

- The participation of the student in any of the acts of evaluation of the course will imply the condition of presented and, therefore, the assignment of a qualification.
- Attendance at a minimum of 80% of practical classes (laboratory, industry visits, seminars) is mandatory, which cannot be recovered.
- To pass the course, students must obtain at least a score of 5 points out of 10 in the partial exam and in the final exam, and a minimum of 4 points out of 10 in each of the other evaluation sections (practical classes, project). In any case, the overall qualification required to pass the course, resulting from the weighted sum of all the evaluation sections, will be 5 points out of 10.
- Students may waive the continuous assessment system through the procedure and within the period established by the School. If such resignation is requested and authorized, 100% of the grade will be assigned by taking a final exam, in which questions can be asked about all the topics taught in the course, including those corresponding to

practical classes.

2. Considerations about the exams (partial and final).

- **Partial exam.** During the course there will be a partial and eliminatory test, which will include problems and/or exercises, as well as essay questions, and which will have a weight in the overall grade of 30 %. To pass this test, a score of at least 5 points out of 10 must be obtained.

- **Final exam 1st opportunity.** It will include the contents not evaluated in the partial test, and will have a relative weight of 30 % in the overall grade of the course. In case of not having passed the partial test, the students will be given the opportunity to repeat the evaluation of the corresponding contents, on the same date assigned for the final exam.

- **Final exam 2nd opportunity.** The exam may put forward questions about all the subjects taught in the course, including those corresponding to practical classes. Students who have obtained the minimum qualification established in this guide for the various evaluation sections (practical classes, project, partial exam), may only be assessed for the rest of the content.

3. Considerations on the qualification records

- **1st opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out (practical classes, project, partial exam and final exam), provided that the minimum required grades have been passed (4 points out of 10 in practical classes and project, 5 points out of 10 in partial and final exams). In case of failing or not showing up for the partial and/or final exam, the record will reflect the Fail rating, with a numerical value resulting from the weighted sum of the practical classes and project grades, applying the global grade contribution percentages specified in this guide; the contents approved in these two sections will be considered as passed with a view to the 2nd opportunity qualification record.

- **2nd opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out, provided that the minimum required marks have been passed. In case of failing or not taking the final exam, the record will reflect the Fail grade, with a numerical value resulting from the weighted sum of the practical classes and project grades, applying the global grade contribution percentages specified in this guide.

4. Ethical considerations

The student is expected to exhibit an adequate ethical behavior. In 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 Fail (0.0).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The introduction of a non-authorized electronic device in the exam room will be considered a reason for not passing the subject in this academic year and the overall rating will be Fail (0.0)

Updated exam calendar: https://eei.uvigo.es/gl/alumnado/planificacion-academica/calendario-de-exames/

Lecturer acting as course coordinator: María Asunción Longo González

Sources of information
Basic Bibliography
Henry C. Vogel; Celeste L. Todaro, **Fermentation and biochemical engineering handbook: principles, process design and equipment**, 3ª, Elsevier, 2014
Mario Díaz, **Ingeniería de bioprocesos**, 3ª, Paraninfo, 2021
Pauline M. Doran; Kate Morrisey; Ross P. Carlson, **Bioprocess Engineering Principles**, 3ª, Academic Press, 2025
Michael R. Ladisch, **Bioseparations engineering : principles, practice, and economics**, 1ª, Wiley, 2001
Fikret Kargi, **Bioprocess Engineering: basic concepts**, 2ª, Pearson Education, 2014
Wim Soetaert, Erick J. Vandamme, **Industrial biotechnology : sustainable growth and economic success**, 1ª, Wiley-VCH, 2010
Complementary Bibliography
Toshiomi Yoshida, **Applied bioengineering : innovations and future directions**, 1ª, Wiley-VCH, 2017
H.N. Thatoi; S. Mohapatra; S.K. Das, **Bioprospecting of enzymes in industry, healthcare and sustainable environment**, 1ª, Springer, 2021
Christian Larroche, **Current developments in biotechnology and bioengineering. : Bioprocesses, bioreactors and controls**, 1ª, Elsevier, 2017

José A. Teixeira; Antonio A. Vicente, **Engineering aspects of food biotechnology**, 1ª, CRC Press, 2014
Robin Smith, **Chemical process design and integration**, 2ª, John Wiley & Sons, 2016

Recommendations

Subjects that continue the syllabus

Modelling of biotechnological processes/V12G350V01924

Subjects that are recommended to be taken simultaneously

Product optimisation/V12G350V01701

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405
Chemical engineering 2/V12G350V01503
Reactors and biotechnology/V12G350V01601

IDENTIFYING DATA				
Industrial organic chemistry				
Subject	Industrial organic chemistry			
Code	V12G350V01923			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Longo González, María Asunción			
Lecturers	Longo González, María Asunción			
E-mail	mlongo@uvigo.es			
Web				
General description	In this course, the fundamental aspects related to the structure of organic compounds and their reactions are presented. Particular attention will be paid to polymerization methods and techniques, and to the intermediate chemicals most frequently used on an industrial scale, as well as other sectors of interest in the organic chemical industry.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
(*)	B3	C4	D10 D16 D17
New	B3 B4	C4	D2 D9 D10 D16 D17
New	B3 B4	C4	D2 D9 D10 D16 D17
New	B3 B4	C4	D10 D16 D17

Contents	
Topic	
1. The organic chemical industry.	1.1. Introduction and general characteristics. 1.2. Raw materials 1.3. Petrochemistry 1.4. Intermediate products and final products.

2. Fundamental concepts of organic chemistry.	2.1. Bonds, hybridisation and geometry. 2.2. Hydrocarbons. Aromaticity. Resonant structures. 2.3. Functional groups. 2.4. Intermolecular interactions 2.5. Conformations and isomery.
3. Reactivity of organic compounds.	3.1. Kinetics and mechanisms of reaction. 3.2. Homogeneous and heterogeneous catalysis. 3.3. Reactivity of organic compounds. 3.3.1. Reactivity of substrates 3.3.2. Electronic structure of reagents. 3.3.3. Reaction intermediates 3.4. Types of organic reactions.
4. Ethylene. Propylene. Intermediate and end-products. Polymerisation.	4.1. Addition reactions. 4.2. Industrial products from ethylene. 4.3. Industrial products from propylene. 4.4. Polymeric materials. Classifications. 4.4.1.Polymerisation reactions. Additions and condensations. 4.4.2. Polyethylene and polypropylene.
5. Fraction C4. Dienes and polyenes. Intermediate and end-products. Fibres and elastomers.	5.1. Butenes. 5.2. Dienes, types and characteristics. 5.3. Synthesis of Diels Alder. 5.4. Elastomers. 5.4.1. Isoprene rubbers. 5.4.2. Isobutylene rubbers. 5.4.3. 1,3-butadiene rubbers. 5.5. Fibres 5.5.1. Acrylic, polyamides and polyesters.
6. Fraction BTX. Intermediate and end-products. Resins.	6.1. Reactivity of the arenos. Benceno. 6.2. Effect of substituentes. Activators and deactivators. 6.3. Industrial derivatives of toluene. 6.3.1. Production of phenol and its derivatives. Phenolic and epoxi resins 6.3.2. Polyesters. Styrene polymers.
7. Other organic compounds of industrial interest.	7.1. Nitrogen compounds. 7.1.1. Dyazonium salts . Dyes and pigments. 7.2. Halogenated compounds. Solvents and insecticides. 7.3. Oxygene compound. Organic acids, alcohols and ketones of industrial interest. 7.4. Tensoactive agents. Types and characteristics.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	9	27.5	36.5
Laboratory practical	18	18	36
Mentored work	1.5	14	15.5
Lecturing	16	40	56
Problem and/or exercise solving	2	0	2
Presentation	2	0	2
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
Problem solving	Throughout the course, exercises will be solved, either in the classroom or autonomously by the students, and handed out for evaluation if needed.
Laboratory practical	Laboratory practices will be carried out, and they will include questions or exercises, which must be submitted for evaluation. This activity is mandatory to pass the course.
Mentored work	Topics related to the contents of the course will be proposed to the students, so that they prepare an individual or group work on any of them.
Lecturing	It will consist of the exposition of the contents of the course, based on the proposed bibliography and the documentation provided on the FAITIC platform

Personalized assistance

Methodologies	Description

Lecturing	Personalized attention to students will be provided for all activities in the course, in the hours scheduled for tutorials.
Problem solving	Personalized attention to students will be provided for all activities in the course, in the hours scheduled for tutorials.
Laboratory practical	Personalized attention to students will be provided for all activities in the course, in the hours scheduled for tutorials.
Mentored work	Personalized attention to students will be provided for all activities in the course, in the hours scheduled for tutorials.

Assessment

	Description	Qualification	Training and Learning Results		
Laboratory practical	Attitude, participation and quality of the work carried out in the laboratorywill be considered. In addition the student will respond to questions raised in each of the practices, and deliver the required lab reports.	20	B3 B4	C4	D9 D16 D17
Problem and/or exercise solving	Partial tests will be carried out, which will include short answer questions and problems, for the evaluation of the skills acquired in relation to the contents of the course.	30	B3	C4	D9 D16
Presentation	The quality of the contents of the delivered work will be evaluated, together with the presentation and the answers to the questions.	20	B3 B4	C4	D10 D16 D17
Objective questions exam	There will be a final exam, which will include short questions and problems, to evaluate the acquisition of the competences of the course.	30	B3 B4	C4	D2 D9 D16

Other comments on the Evaluation

1. Considerations on continuous evaluation.

- The participation of the student in any of the acts of evaluation of the course will imply the condition of presented and, therefore, the assignment of a qualification.
- Attendance at a minimum of 80% of laboratory practices is mandatory, which cannot be rescheduled.
- To pass the course, students must obtain at least a score of 5 points out of 10 in all the evaluation sections (laboratory practices, project, partial exam, final exam). So, the overall qualification required to pass the course, resulting from the weighted sum of all the evaluation sections, will be 5 points out of 10.
- Students may waive the continuous assessment system through the procedure and within the period established by the School. If such resignation is requested and authorized, 100% of the grade will be assigned by taking a final exam, in which questions can be asked about all the topics taught in the course, including those corresponding to practical classes.

2. Considerations about the exams (partial and final).

- **Partial exam.** During the course there will be a partial and eliminatory test, which will include short questions and problems or exercises, and which will have a weight in the overall grade of 30 %. To pass this test, a score of at least 5 points out of 10 must be obtained.
- **Final exam 1st opportunity.** It will include the contents not evaluated in the partial test, and will have a relative weight of 30 % in the overall grade of the course. In case of not having passed the partial test, the students will be given the opportunity to repeat the evaluation of the corresponding contents, on the same date assigned for the final exam.
- **Final exam 2nd opportunity.** The exam may put forward questions about all the subjects taught in the course, including those corresponding to practical classes.Students who have obtained the minimum qualification established in this guide for the various evaluation sections (laboratory practices, project, partial exam), may only be assessed for the rest of the content.

3. Considerations on the qualification records

- **1st opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out (laboratory practices, memory and presentation of project, written exams), provided that the minimum required grades have been passed. In case of failing or not showing up for the partial and/or final exam, the record will reflect the Fail rating, with a numerical value resulting from the weighted sum of the laboratory practices and the project, applying the global grade contribution percentages specified in this guide; the contents approved in these two sections will be considered as passed with a view to the 2ndopportunity qualification record.

- **2nd opportunity qualification record.** The global mark will be the weighted sum of those obtained in all the assessments carried out, provided that the minimum required marks have been passed.In case of failing or not taking the final exam, the record will reflect the Fail grade, with a numerical value resulting from the weighted sum of the laboratory practices and the project, applying the global grade contribution percentages specified in this guide

4. **Ethical considerations**

The student is expected to exhibit an adequate ethical behavior. In 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 Fail (0.0).

The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The introduction of a non-authorized electronic device in the exam room will be considered a reason for not passing the subject in this academic year and the overall rating will be Fail (0.0)

Updated exam calendar: https://eei.uvigo.es/gl/alumnado/planificacion-academica/calendario-de-exames/

Lecturer acting as course coordinator: María Asunción Longo González

Sources of information

Basic Bibliography

Primo Yúfera, E., **Química orgánica básica y aplicada. Tomo I y II.**, Reverté,

Harold, A. Wittcoff, **Productos químicos orgáncios industriales. Vol 1. Materias primas y fabricación.**, Limusa,

Philip S. Baley, **Química orgánica. Conceptos y aplicaciones**, Pearson,

Mª José Climent Olmedo, et al., **Química orgánica. Principales aplicaciones industriales.**, Univ. Politécnica de Valencia,

Harold A. Wittcoff, **Productos químicos orgánicos industriales. Vol 2. Tecnología, formulaciones y usos.**, Limusa,

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Green, Mark M., **Organic chemistry principles and industrial practice.**, Wiley -VCH,

McMurry, **Química orgánica.**, Cengage,

Harold A. Wittcoff, **Industrial Organic Chemicals**, Wiley,

Issa Katime Amashta, et al., **Introducción a la ciencia de los materiales poliméricos. Síntesis y caracterización.**, Univ. País Vasco.,

Recommendations

Subjects that are recommended to be taken simultaneously

Bioelectrochemistry/V12G350V01921
Biotechnological processes and products/V12G350V01922

Subjects that it is recommended to have taken before

Chemistry: Chemistry/V12G350V01205
Experimentation in industrial chemistry 1/V12G350V01505
Experimentation in industrial chemistry 2/V12G350V01602
Chemical engineering 2/V12G350V01503
Industrial chemistry/V12G350V01504

Other comments

To enroll in this course it is necessary to have passed or be enrolled in all the subjects of the courses lower than the course in which this subject is scheduled.

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

IDENTIFYING DATA				
Modelling of biotechnological processes				
Subject	Modelling of biotechnological processes			
Code	V12G350V01924			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Deive Herva, Francisco Javier			
Lecturers	Álvarez Álvarez, María Salomé Deive Herva, Francisco Javier			
E-mail	deive@uvigo.es			
Web	http://https://moovi.uvigo.gal/			
General description	Since ancient times, man has used biotechnological processes to obtain products of interest. Currently, the biotechnology sector is one of the areas that is experiencing the greatest growth, which entails the need to select, within a space of possibilities, those alternatives that, based on a predetermined criterion, allow meeting the desired objectives . The search for a formal approach to the design problem promotes the need to find mathematical models that fit the empirical data and that allow greater ease in the optimization and simulation of these processes. All this will result in greater efficiency and ease of control of the diversity of biotechnology-based processes. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B3	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.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
C21	CE21 Ability to design and management procedures applied experimentation, especially for the determination of thermodynamic and transport properties, and modeling of phenomena and systems in the field of chemical engineering, systems with fluid flow, heat transfer, mass transfer operations, kinetics of chemical reactions and reactors.
C22	CE22 Ability to design, manage and operate simulation procedures, control and instrumentation of chemical processes.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D8	CT8 Decision making.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D15	CT15 Objectification, identification and organization.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Knowledge of complex dynamic phenomena by simulation or by reconstruction in simple laboratory models	B3 B6 B10	C19 C21	D2 D6 D8 D9 D10 D14 D15

Understand the integration of equipment for the correct design of a biotechnological process	B3	C19 C22	D8 D9 D15
Know how to apply control techniques to biotechnological processes	B4 B6 B10	C21 C22	D2 D6 D8 D9 D10 D14 D15 D17

Contents	
Topic	
Subject 1. Introduction to the modelling of biotecnological processes.	Models and types of models in biotechnology. Hierarchical analysis in modelling.
Subject 2. Sequential modelling of bioprocesses.	Integral analysis of biotechnological processes. Use of simulation tools. SuperProDesigner.
Subject 3. Mathematical modelling.	Obtaining empirical data. Characterisation and control of biotechnological processes. Microbial kinetics
Subject 4. Numerical methods in bioprocesses.	Linear and non linear equations. Ordinary differential equations.
Subject 5. Introduction to the design of experiments in bioprocesses	Factorial designs. Utilisation of specific software for the design of experiments
Subject 6. Design of basic units in a biotechnological process.	Design of equipment like tanks and pipes. Scaling-up

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	15	30	45
Mentored work	10	40	50
Laboratory practical	18	18	36
Presentation	3	6	9
Essay 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
Introductory activities	In this activity the different parts and topics developed during the course will be presented to the students, as well as the aims, competences and evaluation criteria. Likewise, the project case will be given to different groups and the way to tackle it will be it will explained
Lecturing	Lecturing will be structured by following the contents distribution in a sequential manner, and highlighting the foundations and more difficult parts to be understood by the students. The lecturer will facilitate, through moovi platform, the material required for a correct follow-up of the matter. The student will have to work on the material prior to the lecture and consult the recommended bibliograpy to complete the information.
Mentored work	Along the course, the students will develop a work consisting in modelling and simulating a biotechnological plant, based on scientific literature and laboratory data. A report must be carried out where all the details, simulation, modelling, data discussion, control strategy, plans, etc. are included.
Laboratory practical	The students will perform laboratory experiments , and all the required material will be available for them in the laboratory to ease their ability to sucessfully carry out biotechnological tasks like media preparation, enzyme determination, plate culturing or bioreactor set up. They will also perform visits to imporant biotechnological companies from our surroundings like Lonza Biologics. The student will prepare a final report in which the main results and conclusions must be collected, in accordance with a guide that will be facilitated them through the platform tem@.
Presentation	The students will make a public defence on the simulation projects, and will be evaluated by a jury composed by lecturers from the department of chemical engineering and/or professionals from the private sector in the field of the chemical engineering

Personalized assistance	
Methodologies	**Description**

Lecturing	During the tutorships, individually or in groups, the student may ask the lecturer about any doubt posed on the matter. Likewise, the students also will be able to do queries to the professor through the moovi platform or by email. The lecturer will inform on the available schedule in the presentation of the matter and in moovi platform
Mentored work	During the tutorships, individually or in groups, the student may ask the lecturer about any doubt posed on the matter. Likewise, the students also will be able to do queries to the professor through the moovi platform or by email. The lecturer will inform on the available schedule in the presentation of the matter and in moovi platform
Laboratory practical	During the tutorships, individually or in groups, the student may ask the lecturer about any doubt posed on the matter. Likewise, the students also will be able to do queries to the professor through the moovi platform or by email. The lecturer will inform on the available schedule in the presentation of the matter and in moovi platform
Presentation	During the tutorships, individually or in groups, the student may ask the lecturer about any doubt posed on the matter. Likewise, the students also will be able to do queries to the professor through the moovi platform or by email. The lecturer will inform on the available schedule in the presentation of the matter and in moovi platform

Assessment

	Description	Qualification	Training and Learning Results		
Mentored work	During some sessions, the students will develop a work on a biotechnological process that will be exposed in front of a jury, that will evaluate it in accordance with some quality criteria	25	B4 B6 B10	C19 C21 C22	D2 D6 D8 D9 D10 D14 D15 D17
Laboratory practical	The students will develop laboratory practices on biotechnological processes, going from data obtaining to process modelling and simulation. After the practical session, a report must be delivered where the main results are critically discussed	15	B3 B6	C19	D2 D6 D8 D9 D14 D17
Presentation	The project will be exposed to a jury composed by lecturers and/or professionals from private companies of chemical engineering.	20	B4 B6 B10		D2 D6 D8 D14 D15 D17
Essay questions exam	A global evaluation of the competencies described in the matter will be carried out at the end of the teaching period. To pass the exam, the students will have to get a minimum of 50% of the maximum mark.	40	B3 B4 B10	C19 C21 C22	D2 D6 D8 D9 D10 D14 D15 D17

Other comments on the Evaluation

The participation of the student in any of the evaluation activities involve that she/he will be subjected to assessment and involves a "presented" mark. A total of 5 points out of 10 should be reached to pass the subject. Analogously, the essay questions exam must be qualified with 5 out of 10 to pass the suject. It is expected that the student shows an ethical behaviour in what it concerns to copy, plagiarism, utilisation of unauthorised electronic devices or commitment with the team work. Otherwise, it will be considered that the student does not meet the indispensable requirements to pass the matter. In this case, the global qualification in the present academic course will be "fail" (0). Finally, the utilisation of any electronic device during the evaluation will not be allowed except for a explicit permission. In case of detecting his presence in the classroom during the examination the student will be assesed with a global mark "fail".

Sources of information

Basic Bibliography

Bjorn K. Lydersen, **Bioprocess Engineering: Systems, Equipment and Facilities**, Jouhn Wiley, 1994

Jonh Smith, **Biotechnology**, 5º, Cambridge University Press, 2009

G.D. Najafpour, **Biochemical Engineering and Biotechnology,**, Elsevier, 2007
Pauline M. Doran, **Bioprocess Engineering Principles,**, Elsevier Science and Technology, 1995

Complementary Bibliography

H.G. Vogel and C.L. Todaro, **Fermentation and Biochemical Engineering Handbook, Principles, Process Design and Equipment**, 2º, Noyes publications, 1997
M. Rodríguez Fernández, **Modelado e identificación de bioprocesos,**, 2006

Recommendations

Subjects that are recommended to be taken simultaneously

Biotechnological processes and products/V12G350V01922

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405
Chemical engineering 2/V12G350V01503
Industrial chemistry/V12G350V01504
Reactors and biotechnology/V12G350V01601

Other comments

To enrol in this matter it is necessary to have passed or be enrolled in all the matters of previous courses of the degree

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

IDENTIFYING DATA				
Environmental management techniques				
Subject	Environmental management techniques			
Code	V12G350V01925			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator	Domínguez Santiago, María de los Ángeles			
Lecturers	Domínguez Santiago, María de los Ángeles García del Río, Pablo			
E-mail	admguez@uvigo.es			
Web				
General description	In this *asignatura tackle the main appearances of the management of waste, *tecnicas of treatment of the same and minimisation of waste			

Training and Learning Results	
Code	
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
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.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.

Expected results from this subject	Training and Learning Results		
Know the methods of minimisation and revalorization of waste.		C16	D10
Know the methods of treatment of toxic and dangerous waste.		C16	D9
Master the tools of environmental management in the Chemical Industry.	B4		D2 D9 D10
Know the environmental legislation that affects the industrial processes.	B7	C16	D2 D9 D10
Know apply the acquired knowledge to practical cases.	B4 B7	C16	D2 D9 D10 D17

Contents	
Topic	
Subject 1.- Waste	General concepts. Classification of the waste. Toxic and dangerous waste. Applicable legislation
Subject 2.- Treatment of waste	Definition. Legislation. Treatments of the waste. Centres of treatment
Subject 3.- Sustainability. Minimisation of industrial waste. Best available techniques.	Sustainability. Stages of a program of minimisation. Technicians of minimisation of the pollution. Application of the best available techniques to a process.
Subject 4.- Life Cycle Assessement	Definition. Stages of the LCA. Applications

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	60	86
Mentored work	10	3.5	13.5
Presentation	2	4	6

Problem solving	10	10.5	20.5
Essay questions exam	2	10	12
Problem and/or exercise solving	2	10	12

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

Methodologies

	Description
Lecturing	Theoretical class in which the professor will expose the most notable appearances of each subject, taking like base the available documentation in the platform Tema.
Mentored work	The students will make a work related with the best available technicians applicable to a process. The main points that the students have to develop and the bibliography recommended will be indicated.
Presentation	The students will make an oral presentation of the work made and will answer to the questions made by the professor and by the other students.
Problem solving	Some exercises will be solved in class and others will be solved by the students and delivered ion time

Personalized assistance

Methodologies	Description
Problem solving	The students can solve any doubts during the assigned hours.
Mentored work	The work will be monitored along the course.

Assessment

	Description	Qualification	Training and Learning Results		
Mentored work	The students will realise and will deliver the work assigned.	10	B7		D9 D10 D17
Presentation	The students will realise an oral presentation of an assigned work	10		C16	D9
Problem solving	The students will have to realise and deliver the exercises proposed.	15	B4 B7	C16	D2 D9
Essay questions exam	The students will realise an exam of all the subject	25	B7	C16	D9
Problem and/or exercise solving	It will make a proof of practical application on management of waste	40	B4	C16	D2 D9

Other comments on the Evaluation

It is precise to reach aminimum gradea of 3,5/10 in each one of the sections evaluables.

Second opportunity: the qualifications of the sectionsmentored work, presentation and problem solving will be maintained

The students that renounce to the continuous evaluation have to make an examination of all the matter in the date fixed by the EEI for these exams

Commitment ethic: it expects that the student present a behaviourethic suitable. In the case to detect a behaviour no ethic (copy, plagiarism, use of devices unauthorised, and others)it will be consedered that the student fails to meet the necessary requirements to pass the matter. In this case the qualification in the present course will be failing grade (0.0).

Sources of information

Basic Bibliography

J.J. Rodriguez y A. Irabien, **Los residuos peligrosos, caracterización, tratamiento y gestión**, Síntesis, 1999

W. Klopffer, B. Grahl, **Lyfe Cycle Assessment: a guide to best practice**, Wiley-VCH, 2014

Complementary Bibliography

D.T. Allen, D.R. Shonnard, **Green Engineering. Environmentally conscious design of chemical processes**, Prentice-Hall, 2002

Recommendations

Other comments

IDENTIFYING DATA				
Internships: Internships in companies				
Subject	Internships: Internships in companies			
Code	V12G350V01981			
Study programme	Grado en Ingeniería en Química Industrial			
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	V12G350V01991			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Tecnoloxía electrónica			
Coordinator	Eguizábal Gándara, Luis Eduardo			
Lecturers	Eguizábal Gándara, Luis Eduardo			
E-mail	eguizaba@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 a redacción, sinatura 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.
B2	CG2 Capacidade para a dirección das actividades obxecto dos proxectos de enxeñaría descritos na 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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
B10	CG10 Capacidade para traballar nun medio multilingüe e multidisciplinar.
B12	CG12 Exercicio orixinal a realizar individualmente e presentar e defender ante un tribunal universitario, consistente nun proxecto no ámbito das tecnoloxías específicas da Enxeñería Industrial no campo de Química Industrial de natureza profesional no que se sinteticen e integren as competencias adquiridas nos ensinos.
D4	CT4 Comunicación oral e escrita de coñecementos en lingua estranxeira.
D12	CT12 Habilidades de investigación.
D13	CT13 Capacidade para comunicarse por oral e por escrito en lingua galega.

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	0	15
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
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

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	V12G350V01999			
Study programme	Grao en Enxeñaría en Química Industrial			
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 a redacción, sinatura 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.
B2	CG2 Capacidade para a dirección das actividades obxecto dos proxectos de enxeñaría descritos na 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 capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química 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