

(*)Escola de Enxeñaría Industrial

Degree in Industrial Technologies Engineering

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

IDENTIFYING DATA				
Applied electrotechnics				
Subject	Applied electrotechnics			
Code	V12G360V01501			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Garrido Suárez, Carlos			
Lecturers	Garrido Suárez, Carlos Novo Ramos, Bernardino			
E-mail	garridos@uvigo.es			
Web	http://http://faitic.uvigo.es/			
General description	The subject of Applied Electrotechnics has like general aim complete the training of the students that go to study the Degree of Engineering in Industrial Technologies in the Theory of Circuits and of the Electric Machines so as to suplly him specific tools that allow him board, analyze and evaluate the behaviour of the electric circuits so much in stable as in transitory regime. The subject is conceived to suplly knowledges, objective and competitions that are necessary to board with guarantees other subjects of the courses 3º and 4º. To a suitable use of this subject and that do not suppose a additional effort for the student, would owe to have studied previously the subjects of Bases of Theory of Circuits and Electric Machines and Calculation I and II since we will give by imparted basic knowledges of both subjects that serve of starting point stop the development of the Applied Electrotechnics.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C22	CE22 Applied knowledge of electrical engineering
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D17	CT17 Working as a team.
D19	CT19 Personal relationships.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Comprise the behavioural basic aspects of the electric circuits in front of a change of conditions	B3	C22	D1 D2 D6 D10 D14 D17 D19
Dominate the available current techniques for it analysis of electric circuits triphases balanced and unbalanced	B3	C22	D1 D2 D6 D10 D14 D17 D19
Know the techniques of measure and register of data in the real electric circuits	B3	C22	D1 D2 D6 D10 D14 D17 D19

Purchase skills envelope the process of analysis of electric circuits (transformers) also in regime of foul	B3	C22	D1 D2 D6 D10 D14 D17 D19

Contents	
Topic	
SUBJECT I: CIRCUITS OF THAT TRIPHASES. MEASURES. COMPENSATION. With this subject, intends that the student know to #analyze circuits triphases so much balanced how unbalanced. It initiates the subject with the basic concepts stop the analysis of circuits balanced. It continues with the unbalanced circuits, the different methods to measure the power and the compensation of power reactivates as well as the methods to determine the sequence of phases. It finalizes with an introduction to the symmetrical components.	□ Introduction: Generators, cargos and circuits triphases. □ Circuits triphases balanced. Tensions and intensities. □ Conversion of sources and triphases charges. □ Analysis of circuits triphases balanced. □ Power in circuits triphases balanced. Compensation. □ Analysis of circuits triphases unbalanced. □ Determination of the sequence of phases and measure of power and energy. □ Symmetrical components.
SUBJECT II: TRANSFORMERS With this subject, intends that the student know the constructive characteristics more important of the transformers as well as determine his characteristic parameters and main properties, as well as his utilization in the electric systems.	□ Analogies between electric and magnetic circuits. □ Introduction to the transformers: constructive aspects. □ The transformer ideal: bases. □ Operation of a transformer real. □ Equivalent circuit of the triphases transformer real: fems and tensions. □ Essay in emptyness and in short-circuit of the transformer. □ Fall of tension, losses and performance of a transformer. □ Autotransformers. □ Transformers triphases: Constitution, diagrams of connection and essays. □ Transformers Of Measure and Protection.

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practises	9	9	18
Practice in computer rooms	9	9	18
Troubleshooting and / or exercises	9	18	27
Master Session	20	60	80
Long answer tests and development	7	0	7
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Laboratory practises	□ Experimental manufacture of the practices or essays proposed, realization of measures and presentation of results.
Practice in computer rooms	□ Simulación by means of computer programs of circuits triphases and transformers.
Troubleshooting and / or exercises	□ Resolution put student with attention customized of problems proposed.
Master Session	□ Exhibition by part of the professor of the contained theoretical of the subject, with clarification of question and punctual doubts that can arise during the exhibition.

Personalized attention	
Methodologies	**Description**
Master Session	The doubts and questions that can arise during the kinds and the personal work of the student will be resolved well in situ or during it time of tutorials. Also it will be possible to attention by means of the email stop the resolution of doubts.
Laboratory practises	The doubts and questions that can arise during the kinds and the personal work of the student will be resolved well in situ or during it time of tutorials. Also it will be possible to attention by means of the email stop the resolution of doubts.

Practice in computer rooms	The doubts and questions that can arise during the kinds and the personal work of the student will be resolved well in situ or during it time of tutorials. Also it will be possible to attention by means of the email stop the resolution of doubts.
Troubleshooting and / or exercises	The doubts and questions that can arise during the kinds and the personal work of the student will be resolved well in situ or during it time of tutorials. Also it will be possible to attention by means of the email stop the resolution of doubts.

Assessment

	Description	Qualification	Training and Learning Results
Long answer tests and development	Continuous assessment (100%): At the end of each subject the student will perform a test that will be scored from 0 to 10 points, reaching the approved with a 5. The test will assess theoretical issues and practical exercises. In each test the student can reach 50% of the final grade. The approved partial tests are released from the corresponding part in the final exam. Students who pass all tests, the final grade will be the weighted average of the marks of the partial tests. For students who suspend or fail to submit to any or all partial tests, they will take a final exam in the official exam that will be scored from 0 to 10 points. To overcome the subject it is necessary to achieve a minimum grade of 3 points in each subject. The students approved by partial tests can modify the note and also present the final test. The examination will indicate the dates and places of publication of grades and revisions.	100	B3 C22 D1 D2 D6 D10 D14 D17 D19

Other comments on the Evaluation

The student only has to realize in the second announcement the mid-terms no surpassed in the first. The final result calculates of the even way that in the first announcement

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Electrical machines/V12G360V01605

Subjects that it is recommended to have taken before

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

Other comments

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

IDENTIFYING DATA				
Enxeñaría de materiais				
Subject	Enxeñaría de materiais			
Code	V12G360V01502			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán			
Department	Enxeñaría dos materiais, mecánica aplicada e construción			
Coordinator	Villagrasa Marín, Salvador			
Lecturers	Villagrasa Marín, Salvador			
E-mail	svillagr@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Nesta materia preténdese axuntar os fundamentos científicos que xustifican a relación entre estrutura, propiedades e comportamento, cos aspectos máis tecnolóxicos da forma en que esas interaccións mutuas ven afectadas polos procesos de elaboración e polas condicións de servizo.			

Competencias	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
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.
B11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
C19	CE19 Coñecementos e capacidades para a aplicación da enxeñaría de materiais.
D1	CT1 Análise e síntese.
D3	CT3 Comunicación oral e escrita de coñecementos na lingua propia.
D5	CT5 Xestión da información.
D7	CT7 Capacidade de organizar e planificar.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D15	CT15 Obxectivación, identificación e organización.
D16	CT16 Razoamento crítico.
D17	CT17 Traballo en equipo.

Resultados de aprendizaxe	
Expected results from this subject	Training and Learning Results

Coñece os principais procesos de conformación e transformación de materiais usados na industria.	B3 B4	C19	D1 D3
Demostra capacidade para seleccionar o proceso de elaboración máis adecuado para a obtención de pezas básicas a partir dun material determinado.	B5 B6		D5 D7
Coñece os principais procesos de unión dos materiais usados na industria.	B11		D9
Comprende as complexas interrelaciones entre as propiedades dos materiais e os procesos de conformación e unión para poder optimizar as propiedades e a produtividade nunha ampla marxe de sectores industriais.			D10 D15 D16
Coñece as características dos materiais máis habitualmente empregados en Enxeñaría.			D17
Coñece a evolución dos distintos tipos de materiais e dos procesos para a súa posible conformación.			
Coñece e aplica os criterios para a selección do material máis adecuado para unha aplicación concreta			
Analiza e propón solucións operativas a problemas no ámbito da enxeñaría de materiais.			
Interpreta, analiza, sintetiza e extrae conclusións e resultados de medidas e ensaios.			
Redacta textos coa estrutura adecuada aos obxectivos de comunicación. Presenta o texto a un público coas estratexias e os medios adecuados			
Demostra capacidades de comunicación e traballo en equipo.			
Identifica as propias necesidades de información e utiliza os medios, espazos e servizos dispoñibles para deseñar e executar procuras adecuadas ao ámbito temático.			
Leva a termo os traballos encomendados a partir das orientacións básicas dadas polo profesor, decidindo a duración das partes, incluíndo achegas persoais e ampliando fontes de información			

Contidos

Topic	
Comportamento mecánico dos materiais. Resposta dos materiais sometidos a procesos de conformado por *fundición, moldeo e inxección. Resposta dos materiais sometidos a procesos de conformado por deformación plástica, *viscoelástica e *compactación de pos. Modificación de materiais mediante tratamentos térmicos, *termoquímicos e *termomecánicos. Tecnoloxías da unión e *soldabilidad. Materiais de construción. Materiais para ferramentas.	.Materiais baixo tensións Deformación plástica Conformado de chapa .Moldeo e defectos de moldeo .*Fractografía
Partes de laboratorio	Ensaios mecánicos Ensaios non destrutivos Ensaios *electroquímicos

Planificación

	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	10	10	20
Traballo tutelado	0	11	11
Titoría en grupo	3	3	6
Resolución de problemas	7	7	14
Lección maxistral	33	66	99

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Metodoloxía docente

	Description
Prácticas de laboratorio	Actividades de aplicación dos *conocimentos e situacións concretas e da adquisición de habilidades básicas e *procedimentales relacionadas coa materia *objecto de estudo. Desenvólvense en *aboratorios con equipamento especializado.
Traballo tutelado	O estudante, de maneira individual ou en grupo, elabora un documento sobre a temática da materia ou prepara seminarios, investigacións, memorias, ensaios, resumos de lecturas, conferencias, etc.
Titoría en grupo	Preténdese facer *unseguimiento do traballo do alumno, así como resolver as *dificulatades que atope na comprensión dos contidos da *asigantura.

Resolución de problemas	Actividade na que o profesor propón aos alumnos unha serie de problemas e/ou exercicios relacionados coa materia, para que traballe sobre eles en casa. O alumno debe desenvolver as solucións adecuadas ou correctas mediante a realización de rutinas, a aplicación de fórmulas ou *algoritmos, a aplicación de procedementos de transformación da información dispoñible e a interpretación dos resultados. A resolución dos problemas farase en clase, por parte do profesor ou dalgún alumno.
Lección maxistral	Exposición oral e directa, por parte do profesor, dos coñecementos fundamentais correspondentes aos temas da materia en cuestión.

Atención personalizada

Methodologies	Description
Traballo tutelado	de artículos de revistas científicas
Titoría en grupo	no hay grupos C

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	As actividades formativas de carácter práctico avaliaranse segundo os criterios de asistencia e grao de participación, informes de desenvolvemento de prácticas ou de visitas a empresas (individuais ou por grupos)	20			D3 D5 D9 D10 D15 D17
Traballo tutelado	Avaliaranse polos informes presentados, e a exposición en clase dos traballos.	20	B3 B4 B11		D3 D9 D10 D15 D17
Lección maxistral	Realizarase mediante unha proba escrita (preguntas curtas e tipo test) que recolla os coñecementos adquiridos polo alumno ao longo do curso.	60	B3 B4 B5 B6 B11	C19	D1 D3 D5 D7 D9 D10 D15

Other comments on the Evaluation

PRIMEIRA EDICIÓN: A avaliación continua realizarase durante o período de impartición da materia segundo os criterios establecidos no apartado anterior. Na primeira edición para superar a materia será necesario alcanzar unha nota mínima de 4 sobre 10 na proba escrita realizada na data previamente fixada polo centro (http://eei.uvigo.es). En caso de non alcanzarse este mínimo a cualificación corresponderase unicamente coa alcanzada durante a avaliación continua (sen sumar a obtida na proba escrita). Aqueles alumnos que renunciasen oficialmente á avaliación continua serán avaliados cun exame final sobre os contidos de a totalidade da materia, que suporá o 100% da nota. SEGUNDA *EDICION (exame de xullo): Non se terá en conta a avaliación continua. A avaliación da segunda convocatoria realizarase mediante un exame escrito no que se abordarán os aspectos máis importantes da materia, tanto en cuestións teóricas como a través de problemas de resolución numérica que permitirá obter o 100% da avaliación. O exame realizarase na data previamente fixada polo Centro (http://eei.uvigo.es). 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

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

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

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

Complementary Bibliography

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

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

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

BROOKS, CH., **Principles of the Surface Treatment of Steels.**, Inc. Lancaster,
M. G. RANDALL, **Sintering: Theory and Practice**, John Wiley & Sons,
P. Beeley, **Foundry Tecnology**, Butterworth-Heineman, Ltd.,

Recomendacións

Subjects that continue the syllabus

Materiais e tecnoloxías en fabricación mecánica/V12G380V01912
Selección de materiais e fabricación de medios de produción/V12G380V01932
Sistemas fluidomecánicos e materiais avanzados para o transporte/V12G380V01942

Subjects that it is recommended to have taken before

Ciencia e tecnoloxía dos materiais/V12G380V01301

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

Competencies	
Code	
B10	CG10 Ability to work in a multidisciplinary and multilingual environment.
C2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
D10	CT10 Self learning and work.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
To know and to understand the physical foundations of electricity and magnetism as well as of vibrations and waves.	B10	C2	
To know and to be able to apply, in simple cases, vector analysis and differential equations of mathematical physics, as problem solving tools within the framework of fundamentals of physics.	B10	C2	
To be able to establish efficient strategies and procedures for solving problems in fundamentals of physics related to industrial technologies.	B10	C2	
To be able to implement specific solutions in the laboratory to experimental problems in fundamentals of physics.	B10	C2	D10

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

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

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

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	20	30	50
Troubleshooting and / or exercises	11.5	30.5	42
Laboratory practises	18	18	36
Short answer tests	2	0	2
Troubleshooting and / or exercises	2	0	2
Reports / memories of practice	0	18	18

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

Methodologies

	Description
Master Session	The main topics of the subject are introduced by the teacher using projected presentations and the blackboard, emphasizing the theoretical basis and fundamentals and stressing the critical or key points. Eventually, demonstrative experiments or audiovisual material could be employed
Troubleshooting and / or exercises	Academic problems related to the topics of the subject are formulated and worked out at the blackboard by the teacher or the students. By practicing standard schemes, formulas or algorithms and by analyzing the results the student must develop adequate skills to be able to obtain the correct solution to the problem on his/her own at the end of the course
Laboratory practises	Practical activities are developed for applying the theoretical knowledge to particular situations and for developing adequate skills to carry out experimental procedures related to the topics. These activities will be held in specific rooms with specialized equipment (hardware and computer labs)

Personalized attention

Methodologies	Description
Master Session	In office hours
Laboratory practises	In office hours
Troubleshooting and / or exercises	In office hours

Assessment

	Description	Qualification	Training and Learning Results
Short answer tests	The questions are related to a particular fundamental point or basic topic for the assessment of the associated learning outcomes. The student must be able to answer them in a direct and clear way showing or revealing its knowledge about fundamentals	50	B10 C2
Troubleshooting and / or exercises	The student must solve problems or exercises on his/her own in a prescribed period of time and previously established conditions. This test could be face-to-face or virtual (using chat, email, forum, audio-conference, etc.)	40	B10 C2 D10

Reports / memories of practice	Each team should write a report on the activities carried out. The report must include the developed tasks and procedures, the obtained results or taken observations, as well as a detailed description of the data processing and analysis	10	B10	C2 D10

Other comments on the Evaluation

1. CONTINUOUS ASSESSMENT

CONTINUOUS ASSESSMENT TESTS (40%)

- Mark ***A0*** **(20%)** will be obtained from short answer tests on topics of Parts I and II

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

FINAL EXAM (60%)

- It is held in the December-January call

- Mark ***T1*** **(30%)** will be obtained from a short answer test on topics of Parts I and II

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

GLOBAL MARK

- The global mark ***G1*** is obtained as

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

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

2. END-TERM ASSESSMENT

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- It is held on the same date as the final exam in the December-January call

- Mark ***A1*** **(20%)** will be obtained from a short answer test on topics of Parts I y II

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

GLOBAL MARK

- In this case the global mark ***G1*** is obtained as

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

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

- A student that had previously obtained marks ***L0*** or ***A0*** (or both) would choose between:

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

b) holding mark ***L0*** and/or mark ***A0*** instead of answering the test corresponding to mark ***L1*** and/or mark ***A1***, respectively

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

FINAL EXAM (60%)

- It is held in the June-July call

- Mark ***T2*** **(30%)** will be obtained from a short answer test on topics of Parts I and II

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

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

- It is held on the same date as the final exam in the June-July call

- Mark ***A2*** **(20%)** will be obtained from a short answer test on topics of Parts I y II

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

GLOBAL MARK

- In this case the global mark ***G2*** is obtained as

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

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

- A student that had previously obtained marks ***L0, L1, A0*** or ***A1*** would choose between:

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

b) holding the most recent marks of each type (***L0*** or ***L1*** and/or ***A0*** or ***A1***) instead of answering the test corresponding to mark ***L2*** and/or mark ***A2***, respectively

4. NOTATION FOR MARKS

- ***L*** = the latest mark among ***L0***, ***L1*** and ***L2***

- ***A*** = the latest mark among ***A0***, ***A1*** and ***A2***

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

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

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

- In any of the calls the global mark ***G*** is obtained as

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

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

5. SUPPLEMENTARY ASSESSMENT RULES

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

- Resources and material that can be used in the tests and final exams:

a) In problem solving test on topics of parts I and II (corresponding to marks ***P1*** and ***P2***) it is allowed to employ notes about theory adequately bound (this includes both the Department lecture notes on the subject and the handwritten notes of the student, exclusively about theory), one textbook and one mathematics handbook (Bronshtein or similar). It is forbidden the user of any workbooks or collections of worked out problems

b) In any other case, the use of any additional resources is forbidden

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

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

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

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

- The date and hours for revision of marks and tests results will be announced in advance. Revision out of this date and hours will be possible only if a reasonable reason for non-attendance is documented

6. ETHICAL COMMITMENT

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

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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

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

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

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

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

I. Bronshtein, **Manual de matemáticas para ingenieros y estudiantes**, MIR, 1992

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

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

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

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

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

IDENTIFYING DATA				
Hydraulic turbomachines				
Subject	Hydraulic turbomachines			
Code	V12G360V01504			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language				
Department				
Coordinator	Martín Ortega, Elena Beatriz Rodríguez Pérez, Luis Meis Fernández, Marcos			
Lecturers	Carrera Pérez, Gabriel Martín Ortega, Elena Beatriz Meis Fernández, Marcos Rodríguez Pérez, Luis			
E-mail	mmeis@uvigo.es emortega@uvigo.es luis.rodriguez.perez2@sergas.es			
Web				
General description	The *asignatura *Turbomáquinas Hydraulic describes the operation of the group of machines that govern by the principle of Euler (machines *rotodinámicas). The knowledge of these machines provides the necessary basic principles to analyse the behaviour of the same in any installation in which they find , as well as the basic principles for his design and *dimensionado.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C8	CE8 Knowledge of the basic principles of fluid mechanics and their application to solving problems in the field of engineering. Calculation of pipes, channels and fluid systems.
C25	CE25 Applied knowledge of the basics of fluidmechanics systems and machines.
D2	CT2 Problems resolution.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
□ Comprise the basic appearances of the machines of fluids	B3	C8 C25	D2 D9 D10
□ Purchase skills on the process of *dimensionado of installations of pumping and machines of fluids	B3	C8 C25	D2 D9 D10

Contents	
Topic	
1.- Introduction	1.- Machines of Fluids. Classification 2.- *Turbomáquinas Hydraulic 3.- Applications to the Industry 4.-Characteristic general
2.- Transfer of Energy	1.- Equation of conservation of the energy 2.- Application to *Turbomáquinas 3.- Adimensional parameters and coefficients of speed 4.-Performances

3.- Similarity and characteristic Curves	1.- Similarity in *turbomáquinas 2.- Practical utilisation of the laws of similarity 3.- Comparison between *turbomáquinas 4.- Characteristic curves in hydraulic bombs 5. Characteristic curves in hydraulic turbines 6. Adimensional coefficients. Specific speed and specific power
4.- Transfer of Work	1.- Fundamental equation of the *Turbomáquinas. Equation of Euler. Distinct expressions of the equation of Euler 2.- One-dimensional ideal theory of *TMH 3.- Two-dimensional ideal theory of *TMH 4.- Real flow. Losses 5.- *Cavitación In *TMH
5.- Machines of fluids of despicable compressibility	1.-Classification 2.- Fans. Characteristic curves 3.- *Aerogeneradores. Classification - Theory of the disk actuator. Limit of *Betz - basic Concepts of aerodynamic profiles - Theory of the element of shovel - Curves of power
6.- Machines of positive trip and hydraulic transmissions	1.- Types and classification 2.- Alternative and rotatory bombs. 3.- Hydraulic engines of positive trip 4.- Transmissions and hydraulic attachments
Practices	1. Introduction to the pneumatic systems: - Description detailed of the pneumatic systems and his components. -Basic circuits. -Resolution of problems proposed 2. Resolution problems of *TMH 3. *Turbomáquinas -Test characterisation turbine Francis 4. Resolution of problems of *MDP

Planning			
	Class hours	Hours outside the classroom	Total hours
Master Session	32	60	92
Laboratory practises	6	7	13
Troubleshooting and / or exercises	12	18	30
Long answer tests and development	3	0	3
Troubleshooting and / or exercises	0	12	12
Other	0	0	0
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Master Session	Exhibition of the theory *Traslación of technical problems to mathematical models.
Laboratory practises	Practices of pneumatic (see description in contents) Practices of *TH (see description in contents)
Troubleshooting and / or exercises	Technicians of design and calculation Presentation and interpretation of solutions. Practical cases

Personalized attention	
Methodologies	**Description**
Troubleshooting and / or exercises	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.
Master Session	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.
Laboratory practises	The professors will attend personally the doubts and queries of the students, so much in the classes as in the *tutorías.

Assessment					
	Description	Qualification	Training and Learning Results		
Long answer tests and development	Proof written that it will be able to consist of: - theoretical Questions - practical Questions - Resolution of exercises/problems - Subject to develop	70	B3	C8	D2 D9 D10
Troubleshooting and / or exercises	Resolution of exercises proposed, including: -*Memoría/exercises proposed of practices	20	B3	C8	D2 D9 D10
Other	Active assistance to class	10	B3	C8 C25	D2 D9

Other comments on the Evaluation

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

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

Sources of information

Basic Bibliography

Viedma A., Zamora B., **Teoría y Problemas de máquinas hidráulicas**, 3º Ed., Horacio Escarabajal Editores., 2008
Mataix, C., **Turbomáquinas Hidráulicas**, Editorial ICAI, 1975
Mataix, C., **Mecánica de Fluidos y Máquinas Hidráulicas**, Editorial del Castillo S.A., 1986

Complementary Bibliography

Hernández Krahe, J. M, **Mecánica de Fluidos y Máquinas Hidráulicas.**, UNED, 1998
Krivchenko, G, **Hydraulic Machines: Turbines and Pumps**, 2ª ed., Lewis, 1994
Creus, A., **Neumática e Hidráulica.**, Marcombo Ed., 2011
Karassik, I. J., **Pump Handbook**, 2ª ed., Nueva York, McGraw-Hill., 1986

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

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

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

Competencias	
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.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.

Resultados de aprendizaxe		
Expected results from this subject	Training and Learning Results	
Proporcionar os coñecementos básicos sobre variable complexa, análise de *Fourier e Transformadas integrais, ampliación e tratamento numérico de ecuacións diferenciais e técnicas de resolución de ecuacións non lineais	B3	D1 D2
Aplicar os coñecementos básicos sobre variable complexa, análise de *Fourier e Transformadas integrais, ampliación e tratamento numérico de ecuacións diferenciais e técnicas de resolución de ecuacións non lineais para resolver problemas técnicos	B3	D1 D2

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

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	31	62	93
Prácticas en aulas informáticas	18	27	45
Probas de resposta longa, de desenvolvemento	3	3	6
Resolución de problemas e/ou exercicios	0	6	6
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Exposición da teoría. Translación de problemas técnicos a modelos matemáticos.
Prácticas en aulas informáticas	Técnicas de cálculo e programación, presentación e interpretación de solucións.

Atención personalizada	
Methodologies	**Description**
Lección maxistral	
Prácticas en aulas informáticas	

Avaliación				
	Description	Qualification	Training and Learning	Results
Probas de resposta longa, de desenvolvemento	Realizarase un exame final de resolución de problemas na aula informática onde se poderán utilizar os programas preparados polo alumno, sobre os contidos de toda a materia.	60	B3	D1 D2
Resolución de problemas e/ou exercicios	Avaliación continua: Asistencia as clases teóricas e practicas. Presentación dunha worksheet en Sage cos traballos propostos ó alumno.	40	B3	D1 D2

Other comments on the Evaluation

Para os alumnos que renuncien á avaliación continua o examen final suporá 0 100% da nota.

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

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

IDENTIFYING DATA				
Deseño e ensaio de máquinas				
Subject	Deseño e ensaio de máquinas			
Code	V12G360V01602			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	2c
Teaching language				
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Segade Robleda, Abraham			
Lecturers	Alonso López, José Antonio Segade Robleda, Abraham			
E-mail	asegade@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Esta materia permitirá ao alumno aplicar os fundamentos básicos da Teoría de Máquinas e Mecanismos ao Deseño de Máquinas e coñecer, comprender, aplicar os conceptos relacionados co Deseño de Máquinas e a súa aplicación na Enxeñaría Mecánica. Achegaralle coñecementos, sobre os conceptos máis importantes relacionados co Deseño de Máquinas. Coñecerá e aplicará as técnicas de análises para Deseño de Máquinas, tanto analíticas como mediante a utilización eficaz de software de simulación.			

Competencias	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
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.
B9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
B10	CG10 Capacidade para traballar nun medio multilingüe e multidisciplinar.
B11	CG11 Coñecemento, comprensión e capacidade para aplicar a lexislación relativa a instalacións industriais.
C13	CE13 Coñecemento dos principios de teoría de máquinas e mecanismos.
C26	CE26 Coñecementos e capacidades para o cálculo, deseño e ensaio de máquinas.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral e escrita de coñecementos na lingua propia.
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 de aprendizaxe			
Expected results from this subject	Training and Learning Results		
Coñecemento dos métodos de cálculo que se aplican no campo do deseño mecánico.	B3 B4 B5	C13 C26	D2 D3 D9 D10 D16 D17 D20
Coñecemento e capacidade de deseño de transmisións mecánicas.	B6 B9 B10	C13 C26	D2 D3 D9 D10 D16 D17

Coñecemento dos principios fundamentais que rexen o estudo dos elementos de máquinas	B9 B10 B11	C13 C26	D2 D3 D9 D10 D16 D17 D20
Capacidade de cálculo e análise dos distintos compoñentes dunha máquina.	B3 B9 B11	C13 C26	D2 D3 D9 D10 D16 D17 D20

Contidos	
Topic	
Deseño mecánico	1. Deseño fronte a solicitacions estáticas 2. Deseño fronte a solicitacions dinámicas
Transmisións	3. Introdución aos sistemas de transmisión 4. Engrenaxes (cilíndricos, cónicos, parafusos sen-fin) 5. Eixos e Árbores
Elementos de Máquinas	6. Embragues e Freos 7. Unións roscadas e parafusos de potencia 8. Coxinetes de deslizamiento e rodaxe

Planificación

	Class hours	Hours outside the classroom	Total hours
Resolución de problemas	9	30	39
Prácticas de laboratorio	18	47	65
Lección maxistral	23	19.5	42.5
Resolución de problemas e/ou exercicios	2.5	0	2.5
Probas de resposta curta	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
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.
Lección maxistral	Clase maxistral na que se expoñen os contidos teóricos.

Atención personalizada

Methodologies	**Description**
Prácticas de laboratorio	Facilitarase a asistencia dos alumnos aos grupos de prácticas tentando compatibilizar horarios.

Avaliación

	Description	Qualification	Training and Learning Results		
Prácticas de laboratorio	Valorarase a asistencia e a participación do alumno nas prácticas de laboratorio, as memorias das prácticas de laboratorio e os traballos realizados a partir delas. Evalúanse todolos resultados de apredizaxe	20		C13 C26	D2 D3 D9 D10 D16 D17 D20
Resolución de problemas e/ou exercicios	Avaliarase en exame final/parciais enfocados aos problemas correspondentes aos coñecementos impartidos durante as clases de aula e laboratorio. Se evalúan todos los resultados de aprendizaje Evalúanse todolos resultados de apredizaxe	60	B3 B4 B5 B6	C13 C26	D2 D9 D16

Probas de resposta curta	Avaliarase en exame final/parciais enfocados aos contidos correspondentes aos coñecementos impartidos durante as clases de aula e laboratorio. Se evalúan todos los resultados de aprendizaje Evalúanse todolos resultados de apredizaxe	20	B9 B10 B11	C13 C26	D3 D9 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:

1. A asistencia con aproveitamento ao Laboratorio/Aula informática, a cualificación das memorias entregadas en cada práctica e os traballos desenvolvidos, terán unha valoración máxima de 2 puntos da nota final, esta cualificación conservarase na segunda convocatoria. A asistencia ás prácticas é obrigatoria para poder ser avaliado delas.
2. Para os alumnos que o soliciten no prazo establecido, existirá un exame final de Laboratorio/Traballos tutelados en ambas as convocatorias cunha valoración máxima de 2 puntos.
3. O exame final consistirá na resolución de problemas e preguntas de resposta curta, sendo a repartición de 60% e 20% da nota final simplemente orientativo, dependendo de cada convocatoria. O exame terá unha valoración máxima de 8 puntos da nota final.
4. "Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (copia, plaxio, utilización de aparatos 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)."
5. Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula do exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0.0)."

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

Bibliografía. Fontes de información

Basic Bibliography

Norton, R., **Diseño de Máquinas. Un Enfoque Integrado**, Mc Graw Hill, 2012
Shigley, J.E, **Diseño de en Ingeniería Mecánica**, 9ª edición, Pearson, 2012

Complementary Bibliography

Mott, Robert L., **Diseño de elementos de máquinas**, Pearson, 2006
Lombard, M, **Solidworks 2013 Bible**, Wiley, 2013
Hamrock, Bernard J, et al., **Elementos de Máquinas**, Mc Graw Hill, 2000

Recomendacións

Subjects that it is recommended to have taken before

Ciencia e tecnoloxía dos materiais/V12G360V01301
Resistencia de materiais/V12G360V01404
Teoría de máquinas e mecanismos/V12G360V01303

Other comments

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

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

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

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
C14	CE14 Knowledge and use of the principles of strength of materials.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency in the own language.
D5	CT5 Information Management.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Knowledge of the foundations of the elasticity theory	B3	C14	
Further deepening on mechanics of materials and stress analysis	B3 B4	C14	D2 D10
Knowledge of deformations in beams and shafts	B3 B4	C14	D2 D9
Ability to apply the knowledge of elasticity and mechanics of materials, and to analyze the mechanical performance of machines, structures, and general structural elements	B4	C14	D1 D2 D5 D9
Ability to take decisions about suitable material, shape and dimensions for a structural element subjected to a specific load	B4	C14	D1 D2 D3 D5 D9 D16 D17

Knowledge of different solving methods for structural problems and ability to choose the most suitable method for each specific problem	B4	C14	D1 D2 D5 D9 D16

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Previous studies / activities	0	6	6
Master Session	13	26	39
Troubleshooting and / or exercises	18	22	40
Laboratory practises	18	4	22
Autonomous troubleshooting and / or exercises	0	15	15
Troubleshooting and / or exercises	2	17.5	19.5
Self-assessment tests	0	5	5

Practical tests, real task execution and / or simulated.	1	2	3

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

Methodologies

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

Personalized attention

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

Assessment

	Description	Qualification	Training and Learning Results
Previous studies / activities	The delivery of these exercises will modify the obtained qualification of the continuous assessment (laboratory practices and conceptual tests) as explained in the section of "Other comments and second call" in this guide. It shall be deemed completed when a previous activity fully answer all questions.	0	D3 D5 D9 D10 D17
Laboratory practises	Attendance and active participation in the complete laboratory lessons and practice reports will be assessed. They will be graded from 0 to 10, provided that the student gets a minimum mark in the written examination (minimum mark: 4.5/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	5	B4 C14 D2 D3 D5 D9 D10 D16 D17
Troubleshooting and / or exercises	Exam for the assessment of the module learning outcomes. The exam comprises of brief problems and/or theoretical questions. The duration and precise grading will be communicated at the beginning of the exam.	80	B3 C14 D1 B4 D2 D3 D9
Practical tests, real task execution and / or simulated.	Short exercises and conceptual tests will be taken during the course (within lecture or laboratory hours; grading from 0 to 10). The mark will be added to the exam mark, provided that the student gets a minimum mark in the written examination (minimum mark: 4.0/10). The qualification will be modified by the coefficient introduced in the "Other comments and second call" section in this guide.	15	B3 D9 D16

Other comments on the Evaluation

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

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

The qualification obtained in the laboratory practices in the course 2015/2016 and 2016/2017 (5% of the qualification) will be preserved in 2017/2018, provided the student requests that within an established period in the beginning of the course.

The qualification obtained in the conceptual tests in the course 2015/2016 and 2016/2017 (15% of the qualification) will be preserved in 2017/2018, provided the student requests that within an established period in the beginning of the course.The rating obtained only remain within the language chosen at the time in which he studied the subject.

Comments about continuous assessment:

The handing of previous exercises (within the established period for each exercise) will modify the qualification of laboratory practices and follow-up conceptual tests as following explained:

Qualification of laboratory practices = K□(overall practice grade)/(nr of laboratory sessions)

Qualification of conceptual tests = K □(addition of tests□ grades)/(nr of tests)

K = (nr of previous exercises delivered)/(total nr of previous exercises)

Additional comments:

The absence from a laboratory session, even justified, does not lead to the repetition of the session.

The absence from a test, even justified, does not lead to the repetition of the test.

The date and place of of examinations of all calls shall be determined by the center before the start of course and will make them public .

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

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

Group responsible lecturer: Groups with teaching in Spanish: Aida Badaoui Fernández, Marcos García González Adrián Pérez Riveiro.

Group with teaching in English: Borja Conde Carnero (bconde@uvigo.es)

Reading list for the group in English:

Recommended:

- Hibbeler R.C., Mechanics of Materials, SI Edition, Prentice Hall. 9th. edition

- José Antonio González Taboada , Tensiones y deformaciones en materiales elásticos, 2a Edición, Tórculo.

- José Antonio González Taboada , Fundamentos y problemas de tensiones y deformaciones en materiales elásticos, 1ª Edición, Tórculo.

Complementary:

- Timoshenko, Goodier, Theory of elasticity, 3rd ed., (International student ed.), McGraw-Hill

- Manuel Vázquez , Resistencia de Materiales.

Sources of information

Basic Bibliography

José Antonio González Taboada, **Tensiones y deformaciones en materiales elásticos**,

José Antonio González Taboada, **Fundamentos y problemas de tensiones y deformaciones en materiales elásticos**,

Manuel Vázquez, **Resistencia de Materiales**,

Complementary Bibliography

Luis Ortiz Berrocal, **Elasticidad**,
Robert Mott, Joseph A. Untener, **Applied Strength of Materials**, 6ª, CRC Press, 2016

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mechanics of materials/V12G360V01404

Other comments

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

The original teaching guide is written in Spanish. In case of discrepancies, shall prevail Spanish version of this guide.

IDENTIFYING DATA				
Ingeniería de fabricación				
Subject	Ingeniería de fabricación			
Code	V12G360V01604			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	2c
Teaching language	Castellano			
Department	Diseño en la ingeniería			
Coordinator	Pereira Domínguez, Alejandro			
Lecturers	Pereira Domínguez, Alejandro Pérez García, José Antonio Prado Cerqueira, María Teresa			
E-mail	apereira@uvigo.es			
Web				
General description				

Competencias	
Code	
B3	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.
C20	CE20 Conocimiento aplicado de sistemas y procesos de fabricación, metrología y control de calidad
D1	CT1 Análisis y síntesis.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral y escrita de conocimientos en lengua propia.
D8	CT8 Toma de decisiones.
D9	CT9 Aplicar conocimientos.
D10	CT10 Aprendizaje y trabajo autónomos.
D16	CT16 Razonamiento crítico.
D17	CT17 Trabajo en equipo.
D20	CT20 Capacidad para comunicarse con personas no expertas en la materia.

Resultados de aprendizaje			
Expected results from this subject	Training and Learning Results		
□ Conocer la base tecnológica y aspectos básicos de los procesos de fabricación	B3	C20	D1
□ Comprender los aspectos básicos de los sistemas de fabricación			D2
□ Adquirir habilidades para la selección de procesos de fabricación y elaboración de la planificación de fabricación			D3 D8
□ Desarrollar habilidades para la fabricación de conjuntos y elementos en entornos CADCAM			D9
□ Aplicación de tecnologías CAQ			D10 D16 D17 D20

Contenidos	
Topic	
Bloque Temático I: Integración de Diseño de producto y fabricación.	Leccion 0. Introducción al diseño de producto y de proceso Lección 1. Tecnologías de prototipado rápido y rapid tooling. Lección 2. Tipos y diseño de Sistemas de fabricación. Niveles de automatización. Lección 3. Diseño de producto para fabricación y montaje (DFMA)
Bloque Temático II: Diseño y planificación de procesos de fabricación.	Lección 4. Metodología de Diseño y Planificación de procesos de fabricación. Lección 5. Superficies de referencia, sujeción y utillajes. Lección 6. Selección de operaciones, herramientas utillajes y condiciones de proceso. Lección 7. Técnicas de mejora de diseño y de procesos.

Bloque Temático III: Recursos de los Sistemas de Fabricación.	Lección 8. Descripción y estructura de Máquinas herramienta con Control Numérico. Lección 9. Robots Industriales y manipuladores. Sistemas de posicionamiento, manutención Lección 10. Sistemas de medición y verificación en líneas de fabricación. Definición de Gamas de control

Planificación

	Class hours	Hours outside the classroom	Total hours
Actividades introductorias	2	0	2
Resolución de problemas y/o ejercicios	12	14	26
Prácticas de laboratorio	24	0	24
Trabajos tutelados	0	60	60
Sesión magistral	14	16	30
Pruebas de tipo test	2	0	2
Trabajos y proyectos	2	0	2
Pruebas de respuesta larga, de desarrollo	2	2	4

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

Metodologías

	Description
Actividades introductorias	Presentación asignatura Objetivos Clases teóricas Clases prácticas Evaluación Desarrollo de trabajos. Temática y Desarrollo Recursos Bibliográficos
Resolución de problemas y/o ejercicios	Desarrollo de casos ejercicios adaptado a cada tema incluído en los contenidos
Prácticas de laboratorio	Nº Denominación Medios Horas 1 Diseño de producto y proceso (Pieza para fundir, por ejemplo..) Programa CAD, tipo Catia o similar 2h 2 Diseño y planificación de proceso de fabricación de pieza. Diseño de Utillaje para producto (Ejemplo. Coquilla + electrodo) Programa Cad tipo catia o similar 2h 3 Programación asistida de mecanizado de utillaje. Winunisoft o similar CAM, (Catia, powerMill,) 4h 4 Programación asistida de mecanizado de utillaje. CAM, (Catia, powerMill,) 4h 5 Aplicación Gama medición a utillaje y a pieza (Simulado). CAQ (Catia MSproject 2h 6 Diseño de célula de fabricación y disposición en planta Delmia, Catia, o similar 4h
Trabajos tutelados	Proyecto (Trabajo a realizar por alumno. Correspondería a Grupos C de < de 8 alumnos) Total 18h
Sesión magistral	Exposición básica de contenidos expuestos en el paso 3 Exposición casos prácticos y teóricos

Atención personalizada

Methodologies	Description
Trabajos tutelados	Tutorización de Trabajos y proyectos de grupos de entre 3 y 5 personas.

Evaluación

	Description	Qualification	Training and Learning Results
Pruebas de tipo test	Examen con preguntas tipo test, en las que las respuestas no acertadas descuentan. El test puede conllevar preguntas de tipo problemas y desarrollo.	50	B3 C20 D2 D8 D9 D16

Trabajos y proyectos	Desarrollo de proyecto de curso. Se evaluará, la capacidad de trabajo en equipo, creatividad, trabajo autónomo y en caso de presentación pública la capacidad de comunicación y sintesis.	50	C20	D1 D2 D3 D9 D10 D17 D20
Pruebas de respuesta larga, de desarrollo	Desarrollo de problemas y o casos	50	C20	D1 D2 D8 D9 D10 D16

Other comments on the Evaluation

Las evaluación consta de A.-) Prueba tipo Test y/o problemas- caso : Obligatoria y debe tener una nota 4 para poder compensar con proyecto o con prueba larga Valor 50% B1.-) Trabajo Proyecto: Voluntario. Si no se elige trabajo se hará prueba de respuesta larga con inclusión de problemas. Valor 50% B2.-) Prueba de respuesta larga: Consistente en problemas y o casos. Será realizada por alumnos que no quieran hacer trabajo. Valor 50% Habida cuenta que la nota se compone de A +B, siendo B= B1 o B2 es por lo que, A y tanto B1 como B2 valen el 50 % (que no coincide con los porcentajes de la guía docente)

Compromiso ético: Se espera que el alumno presente un comportamiento ético adecuado. En el caso de detectar un comportamiento no ético (copia, plagio, utilización de aparatos electrónicos no autorizados, y otros) se considerará que el alumno no reúne los requisitos necesarios para superar la materia. En este caso la calificación global en el presente curso académico será de suspenso (0.0).

Fuentes de información

Basic Bibliography

Complementary Bibliography

Pereira A., Prado T., **Apuntes de la Asignatura IF**, 2015,

Kalpakjian, S., **Manufacturing Engineering and Technology**, 7th ed.,

Recomendaciones

Subjects that it is recommended to have taken before

Fundamentos de sistemas y tecnologías de fabricación/V12G360V01402

Other comments

Requisitos:
Para matricularse en esta materia es necesario haber superado o bien estar matriculado de todas las materias de los cursos inferiores al curso en el que está ubicada esta materia.

IDENTIFYING DATA				
Electrical machines				
Subject	Electrical machines			
Code	V12G360V01605			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Prieto Alonso, Manuel Angel			
Lecturers	Novo Ramos, Bernardino Prieto Alonso, Manuel Angel			
E-mail	maprieto@uvigo.es			
Web	http://faiticuvigo.es			
General description	(*)O obxectivo desta materia é dotar ao alumno dunha formación básica, **tando teórica como práctica, sobre as máquinas eléctricas rotativas, en canto á constitución, modos de funcionamento e aplicacións.			

Competencies	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
C10	CE10 Knowledge and use of the principles of circuit theory and electrical machines.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.
D19	CT19 Personal relationships.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
(*)Competencias específicas RI4A.- Ampliación de conocimiento y utilización de los principios de máquinas eléctricas	B3	C10	D1 D10 D16

Los resultados esperados del aprendizaje, son los siguientes:
 Comprender los aspectos básicos de la constitución y funcionamiento de las máquinas eléctricas clásicas
 Conocer el proceso experimental utilizado para la caracterización los distintos tipos de máquinas.
 Conocer las aplicaciones industriales de los distintos tipos de máquinas eléctricas.
 Conocer las máquinas ""clásicas"" y las ""modernas"".

Competencias transversales
CT1.- Capacidad de análisis y síntesis.
CT2.- Resolución de problemas
CT6.- Conocimiento de informática relativos al ámbito de estudio
CP2.- Razonamiento crítico
CP3.- Trabajo en equipo
CP5.- Habilidades en las relaciones interpersonales
CS2.- Aprendizaje autónomo
CS6.- Creatividad
Otras:
X1.- Capacidad de aplicar los conocimientos en la práctica
X2.- Conocimientos básicos de la profesión

New	B3	C10	D1 D2 D6 D10 D16 D17 D19
New	B3		D1 D10 D14 D16
New	B3	C10	D10

Contents	
Topic	
UNIT I: INTRODUCTION TO THE ELECTRICAL MACHINES	I-1 Electromagnetic and electro-mechanic fundamental laws. General behaviour notes: Physical arrangement of the electrical machines. Types of machines. Losses. Energy balance. Efficiency. Heating. Cooling. Rated power. Insulation types. Degrees of mechanical protection and construction types. Nameplate. I-2 Principles of Construction. Magnetic poles. Neutral line. Pole-pitch. I-3 M.M.F□s and E.M.F□s inside the machine: Fields generated with concentrated and distributed windings. Rotating magnetic field. Winding factor.
UNIT II: INDUCTION MOTORS (ASYNCHRONOUS)	II-1 Three-phase induction machine Construction characteristics. Operating principles. Electrical equivalent circuit. Powers and torques. Electrical tests. Energy balance and efficiency. T-s curve. Operation modes. Starting methods and speed control. II-2 Single-phase induction motor Construction characteristics. Operating principles. Electrical equivalent circuit. Starting methods. UNIT III: SYNCHRONOUS MACHINES (GENERATORS) Construction characteristics. Operating principles. Armature reaction. Salient poles and cylindrical rotor machines. Electrical equivalent circuit. Stand-alone and grid-connected behaviours. Synchronous motor: Characteristics and uses
UNIT III: SYNCHRONOUS MACHINES (GENERATORS)	Construction characteristics. Operating principles. Armature reaction. Salient poles and cylindrical rotor machines. Electrical equivalent circuit. Stand-alone and grid-connected behaviours. Synchronous motor: Characteristics and uses.
UNIT IV: D.C. MOTORS. SPECIAL MACHINES	IV-1 Construction characteristics. Operating principles. Excitation systems. Armature reaction. Commutation. Armature reaction. Speed control. IV-2 Special machines: Step Motors, PMDC, Reluctance Motors
UNIT V: PROTECTION AND CONTROL OF ELECTRICAL MOTORS	Low voltage switch gear. Electrical machines protection systems.

Planning			
	Class hours	Hours outside the classroom	Total hours
Master Session	32.5	65	97.5
Laboratory practises	10	16	26
Troubleshooting and / or exercises	8	16	24
Multiple choice tests	1	0	1
Troubleshooting and / or exercises	1.5	0	1.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Master Session	(*) Exposición por parte do profesor dos contidos sobre a materia de máquinas eléctricas.
Laboratory practises	(*) Actividades de aplicación dos coñecementos teóricos a situacións concretas e de adquisición de habilidades básicas e procedimentales relacionadas coas máquinas eléctricas rotativas. Desenvolverase no laboratorio de máquinas eléctricas correspondente.
Troubleshooting and / or exercises	(*) Actividade na que se formulan problemas e exercicios relacionados coa materia de máquinas eléctricas rotativas. O profesor resolverá problemas tipo de máquinas rotativas e o alumno debe resolver problemas similares.

Personalized attention	
Methodologies	**Description**
Master Session	Any question can be arised during the lessons. Office hores are also available for the students
Laboratory practises	During the realization of the practical tests any possible question will be solved.
Troubleshooting and / or exercises	All numerical exercices will be solved in this classes. Q and A will be highly recommended.

Assessment					
	Description	Qualification	Training and Learning Results		
Laboratory practises	The evaluation of the practical laboratory tests will be done in a continuous way (session to session). The evaluation criteria is : - Minimum attendance of 80%. - Punctuality . - Previous preparation of the practical test. - Correct utilization of the material . Practical tests results. Not attending the lab lessons will imply 0 point in this part. Attendance below 80% will imply 0 point in this part. To pass the whole subject, a mark higher than 40% in this part in mandatory.	10	B3	C10	D1 D2 D10 D14 D16 D17 D19
Troubleshooting and / or exercises	The evaluation of the exercises will be done in a continuous way (session to session). The evaluation criteria is : - Minimum attendance of 80%. - Punctuality . - Previous preparation of the exercise, if required. . Correct exercise result, if required. .	5	B3	C10	D1 D2 D6 D10 D16
Multiple choice tests	The assessment method will be a multiple choice test, to be done individually without the use of any information source. There will be one unique test for the whole subject, and it will cover not only the theoretical lessons but the practical lab tests. A minimum mark of 40% will be required in this part.	55	B3	C10	D1 D6
Troubleshooting and / or exercises	The assessment method will be a numerical resolution of an exercise of electrical machines A minimum mark of 40% will be required in this part.	30		C10	D1 D2 D10 D14 D16

Other comments on the Evaluation

Second attempt (July)

If a student does not reach an 80% for the lab lessons or his/her marks are not higher the minimum required, a practical exam will be necessary to pass this part.

To pass the subject a minimum of 5/10 will be required (result of the sum of the 4 subject parts)

Commitment: An student ethical behaviour is expected. If not ethical behaviour is detected (copying, cheating in any way, using unlicensed electronic devices, and others), it will considered that the student does not gather the necessary requirements to pass the subject.

In this case the global qualification in the present academic course will be (0.0). (FAILED)

Sources of information

Basic Bibliography

Jesús Fraile Mora, **Máquinas Eléctricas**, McGraw-Hill/Interameericana de España S.A.U,

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

Stephen J. Chapman, **Máquinas Eléctricas**, McGraw-Hill,

Manuel Cortés Cherta, **Curso Moderno de Máquinas Eléctricas Rotativas (I,II,III)**, Editores Técnicos Asociados,

Complementary Bibliography

Javier Sanz Feito, **Máquinas Eléctricas**, Prentice Hall, 2002
Sanjurjo Navarro, **Máquinas Eléctricas**, García-Maroto, 2011
Suárez Creo, Juan M, **Máquinas eléctricas : funcionamiento en régimen permanente**, Tórculo, 2006
Fitzgerald, Arthur Eugene, **Máquinas Eléctricas**, McGraw-Hill, 2004
Fitzgerald, Arthur Eugene, **Máquinas Eléctricas**, McGraw-Hill, 2004
Fitzgerald, Arthur Eugene, **Máquinas Eléctricas**, McGraw-Hill, 2004

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Basics of circuit analysis and electrical machines/V12G360V01302
Applied electrotechnics/V12G360V01501
Physics 3/V12G360V01503

Other comments

Requirements: To enrol in this subject is necessary to surpass or well be enrolled of all the subjects of the inferior courses to the course in the that is situated this subject.

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

IDENTIFYING DATA				
Tecnoloxía química				
Subject	Tecnoloxía química			
Code	V12G360V01606			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	2c
Teaching language	Castelán			
Department	Enxeñaría química			
Coordinator	Sanroman Braga, María Ángeles			
Lecturers	Longo González, María Asunción Rincón Fontán, Mirian Rosales Villanueva, Emilio Sanroman Braga, María Ángeles			
E-mail	sanroman@uvigo.es			
Web				
General description	Nesta materia os alumnos aprenden os principios básicos da Enxeñaría Química e os fundamentos das operacións de transferencia de materia máis empregadas na industria.			

Competencias	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D3	CT3 Comunicación oral e escrita de coñecementos na lingua propia.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D16	CT16 Razoamento crítico.
D17	CT17 Traballo en equipo.

Resultados de aprendizaxe		
Expected results from this subject	Training and Learning Results	
Coñecer as bases sobre as que se apoia a tecnoloxía química	B3	D9
Aplicar os balances de materia e enerxía a sistemas reais	B4	D1 D2 D3 D6 D9 D10 D16 D17
Coñecer e comprender os aspectos básicos da transferencia de materia	B3	D9
Coñecer os principios das operacións de separación e saber aplicalos a casos reais	B4	D1 D2 D3 D6 D9 D10 D16 D17

Contidos	
Topic	
Introducción	Enxeñería Química. Principios básicos. Procesos Químicos. Conversión de unidades y ferramentas de cálculo.
Balances de materia e enerxía	Balances de materia en sistemas sen reacción química. Balances de materia en sistemas con reacción química. Balances de enerxía

Deseño de reactores químicos	Estequiometría. Velocidade de reacción. Reactores ideais.
Transferencia de materia	Introdución. Ecuacións de transferencia entre fases: coeficientes individuais e globais. Operacións de separación: esquema xeral
Absorción de gases	Columnas de recheo: conceptos xerais. Factores de deseño dun absorbedor
Adsorción	Fundamentos. Cinética e equilibrio de adsorción. Materiais adsorbentes. Operacións en columnas. Aplicacións
Extracción	Fundamentos. Extracción líquido-líquido. Extracción sólido-líquido
Destilación e rectificación de mesturas líquidas	Equilibrio líquido-vapor. Destilación simple. Rectificación. Destilación azeotrópica e extractiva.
Outras operacións de interese nos procesos químicos	Intercambio iónico. Cristalización

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	20	40	60
Resolución de problemas	17	31	48
Prácticas de laboratorio	8	8	16
Resolución de problemas e/ou exercicios	2	8	10
Informe de prácticas	0	2	2
Probas de resposta longa, de desenvolvemento	3.5	10.5	14

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

Metodoloxía docente

	Description
Lección maxistral	Exposición oral e directa, por parte do profesor, dos coñecementos máis importantes correspondentes aos temas da materia en cuestión.
Resolución de problemas	O profesor propón aos alumnos unha serie de problemas para que traballen sobre eles en casa, antes de que aquel resólvaos en clase.
Prácticas de laboratorio	Os alumnos realizarán certas experiencias co obxectivo de consolidar determinados conceptos básicos.

Atención personalizada

Methodologies	Description
Resolución de problemas	Os alumnos poderán consultar ao profesor en calquera das metodoloxías docentes empregadas, así como na revisión das diferentes probas de avaliación realizadas, cantas dúbidas teñan sobre aspectos teóricos e prácticos vinculados coa materia.

Avaliación

	Description	Qualification	Training and Learning Results
Resolución de problemas e/ou exercicios	Realizaranse diversos controis, constando cada un deles de preguntas de resposta curta e problemas. A media dos controis representará o 30% da nota final.	30	B3 B4 D1 D2 D3 D9 D16
Informe de prácticas	Ademais da valoración da memoria de prácticas, terase en conta a asistencia, a actitude e o traballo desenvolvido no laboratorio.	10	D1 D3 D6 D9 D10 D16 D17
Probas de resposta longa, de desenvolvemento	Exame teórico-práctico, a realizar nas datas fixadas polo Centro, que comprenda conceptos e procedementos fundamentais relacionados co contido do temario.	60	B3 B4 D1 D2 D3 D9 D16

Other comments on the Evaluation

No caso de que un alumno non alcance o aprobado en prácticas deberá examinarse delas no mes de Xullo.

Con respecto ao exame de Xullo (2ª convocatoria), manterase a cualificación dos controis realizados e das prácticas (sempre que estas estean aprobadas), polo que os alumnos só realizarán a proba de resposta longa (exame teórico-práctico).

Cando a Escola libere a un alumno do proceso de avaliación continua, a súa cualificación será a suma do 90% da nota obtida na proba de resposta longa (exame teórico-práctico) e do 10% da nota de prácticas.

COMPROMISO ÉTICO:

Espérase que o alumno mostre un comportamento ético adecuado. En caso de detectarse un comportamento eticamente reprobable (por exemplo: copia, plaxio, utilización de dispositivos electrónicos non autorizados, etc) considerarase que o alumno non reune os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0.0).

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

Himmelblau, D.M., **Principios y cálculos básicos de la Ingeniería Química**, 6ª,

Felder, R.M. y Rousseau, R.W., **Principios elementales de los procesos químicos**, 3ª,

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

Coulson, J.M. y otros, **Ingeniería Química, Vol. 1 y Vol. 2**, Traducciones de la 3ª ed. en inglés,

Treybal, R.E., **Operaciones de transferencia de masa**, 2ª,

Calleja, G, **Introducción a la ingeniería química**, 1ª,

Levenspiel, O., **Ingeniería de las reacciones químicas**, 2ª,

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

Física: Física I/V12G360V01102
Física: Física II/V12G360V01202
Matemáticas: Cálculo I/V12G360V01104
Matemáticas: Cálculo II e ecuacións diferenciais/V12G360V01204
Química: Química/V12G360V01205

Other comments

REQUISITOS: 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 discrepancias, prevalecerá a versión en castelán desta guía.