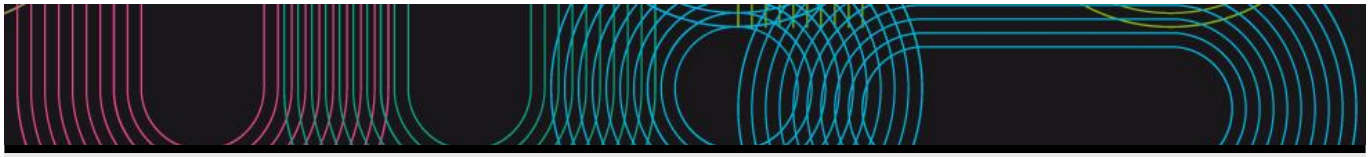

(*)Escola de Enxeñaría Industrial

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

Degree in Industrial Technologies Engineering

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V12G363V01101	Expresión gráfica: Expresión gráfica	1st	9
V12G363V01102	Física: Física I	1st	6
V12G363V01103	Matemáticas: Álxebra e estatística	1st	9
V12G363V01104	Matemáticas: Cálculo I	1st	6
V12G363V01201	Empresa: Introdución á xestión empresarial	2nd	6
V12G363V01202	Física: Física II	2nd	6
V12G363V01203	Informática: Informática para a enxeñaría	2nd	6
V12G363V01204	Matemáticas: Cálculo II e ecuacións diferenciais	2nd	6
V12G363V01205	Química: Química	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V12G363V01301	Ciencia e tecnoloxía dos materiais	1st	6
V12G363V01302	Fundamentos de teoría de circuítos e máquinas eléctricas	1st	6
V12G363V01303	Teoría de máquinas e mecanismos	1st	6
V12G363V01304	Fundamentos de automática	1st	6
V12G363V01305	Fundamentos de organización de empresas	1st	6
V12G363V01401	Tecnoloxía electrónica	2nd	6
V12G363V01402	Fundamentos de sistemas e tecnoloxías de fabricación	2nd	6
V12G363V01403	Mecánica de fluídos	2nd	6
V12G363V01404	Resistencia de materiais	2nd	6

V12G363V01405	Termodinámica e trasmisión de calor	2nd	6

Year 3rd			
Code	Name	Quadmester	Total Cr.
V12G363V01501	Electrotecnia aplicada	1st	6
V12G363V01502	Enxeñaría de materiais	1st	6
V12G363V01503	Física III	1st	6
V12G363V01504	Turbomáquinas hidráulicas	1st	6
V12G363V01505	Matemáticas da especialidade	1st	6
V12G363V01602	Deseño e ensaio de máquinas	2nd	6
V12G363V01603	Elasticidade e ampliación de resistencia de materiais	2nd	6
V12G363V01604	Enxeñaría de fabricación	2nd	6
V12G363V01605	Máquinas eléctricas	2nd	6
V12G363V01606	Tecnoloxía química	2nd	6

IDENTIFYING DATA				
Expresión gráfica: Expresión gráfica				
Subject	Expresión gráfica: Expresión gráfica			
Code	V12G363V01101			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Basic education	1	1c
Teaching language				
Department	Deseño na enxeñaría			
Coordinator	López Figueroa, Concepto Esteban			
Lecturers	Alegre Fidalgo, Paulino Comesaña Campos, Alberto Corralo Domonte, Francisco Javier Díaz Vilariño, Lucía Fernández Álvarez, Antonio González Rodríguez, Elena López Figueroa, Concepto Esteban Patiño Barbeito, Faustino Roa Corral, Ernesto Troncoso Saracho, José Carlos			
E-mail	esteban@uvigo.es			
Web	http://faitic.uvigo.es			
General description	O obxectivo que se persegue con esta materia é formar ao alumno na temática relativa á Expresión Gráfica, ao obxecto de capacitarlle para o manexo e interpretación dos sistemas de representación máis empregados na realidade industrial e as súas técnicas básicas, introducirlle ao coñecemento das formas, xeración e propiedades dos entes xeométricos máis frecuentes na técnica, incluíndo a adquisición de visión e comprensión espacial, iniciarlle no estudo dos aspectos de carácter tecnolóxico que inciden na Expresión Gráfica da Enxeñaría e introducirlle *racionalmente no coñecemento e aplicación da Normalización, tanto nos seus aspectos básicos como nos específicos. A materia desenvolverase de maneira que capacite ao alumno para o emprego *indistinto de técnicas tradicionais e de novas tecnoloxías da información e comunicacións.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CG6	CG6 Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.
CE5	CE5 Capacidade para a visión espacial e coñecemento das técnicas de representación gráfica, tanto por métodos tradicionais de xeometría métrica e xeometría descritiva, como mediante as aplicacións de deseño asistido por ordenador.
CT2	CT2 Resolución de problemas.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.

Resultados de aprendizaxe			
Learning outcomes	Competences		
Coñecer, comprender, e aplicar un conxunto de coñecementos sobre os fundamentos e normalización do debuxo de enxeñaría industrial, no seu concepto máis amplo, propiciando ao mesmo tempo o desenvolvemento da capacidade espacial.	CG3 CG4	CE5	CT6
Adquirir a capacidade para o razoamento abstracto e o establecemento de estratexias e procedementos eficientes na resolución dos problemas gráficos dentro do contexto dos traballos e proxectos propios da enxeñaría.	CG3 CG4	CE5	CT2
Utilizar a comunicación gráfica entre técnicos, por medio da realización e interpretación de planos de acordo coas Normas de Debuxo Técnico, implicando o uso das novas tecnoloxías.	CG6	CE5	CT6 CT9
Asumir unha actitude favorable cara á aprendizaxe permanente na profesión, mostrándose *proactivo, participativo e con espírito de superación.	CG4		CT9

Contidos
Topic

Bloque 0. Debuxo Asistido por Computador 2D. *Croquizado, e aplicación de Normas.	Introdución ao Debuxo Asistido por Computador. Contorna de traballo. Sistemas de Coordenadas. Ordenes de Debuxo. Entidades Gráficas. Axudas ao debuxo. Referencias a entidades. Ordenes de Modificación. Ordenes de Visualización. Ordenes de Consulta. Impresión e escalas. 0.2. *Croquizado, e aplicación de Normas
Bloque *I 2D. Xeometría Plana.	Repaso de coñecementos previos. *Cónicas: definicións, circunferencias focais e principal, *tangente e normal nun punto, *tangentes desde un punto exterior, propio e impropio. *Tangencias entre rectas e circunferencias e entre circunferencias (26 casos). Ferramentas de resolución: lugares xeométricos, operacións de *dilatación e investimento e potencia. Curvas técnicas: *Trocoides: definición, trazado e *tangente nun punto. Outras curvas técnicas.
Bloque *II 3D. Sistemas de representación.	Introdución: Tipos de proxeccións. *Invariantes *proyectivos. Sistema *Diédrico: Fundamentos. Pertenza e Incidencia. Paralelismo e *Perpendicularidad. Distancias, Ángulos. Operacións: Xiros, Cambios de Plano e Abatementos. Superficies: *Poliédricas, Radiadas e de Revolución, Superficies: Seccións Planas, Desenvolvemento. Intersección de Superficies. Fundamentos. Sistema de Planos Acoutados: Fundamentos. Pertenza e Incidencia. Paralelismo e *Perpendicularidad. Distancias, Ángulos. Abatementos. Sistema *Axonométrico: Fundamentos. Escalas *axonométricas. Tipos de *axonometrias: *trimétrica, *dimétrica e *isométrica. Sistema de Perspectiva *Caballera: Fundamentos. Sistema de Perspectiva *Cónica: Fundamento.

Bloque *III. Normalización.	Xeneralidades sobre o debuxo: - O debuxo como linguaxe. - Tipos de debuxos: técnicos e artísticos. - Debuxos técnicos: arquitectónico, topográfico e industrial. - Debuxo industrial: Esbozo, esquemas conxuntos, despezamentos e debuxo xeométrico. Normalización do debuxo: - Vantaxes da normalización. - Diferenza entre regulamento, especificación e norma. Normalización básica: formatos, escritura, tipos de liña, escalas, etc. Representación normalizada: - Principios básicos de representación. Métodos de proxección - Vistas. Vistas particulares: auxiliares, interrompidas, parciais, locais, viradas, etc. - Cortes, Seccións e Roturas: Especificacións, tipos de corte, seccións (abatidas, desprazadas), etc. - Raiado de cortes: tipos de liña, orientación, etc. - *Convencionalismos: pezas simétricas, elementos repetitivos, detalles, interseccióńs, partes *contíguas, etc. Anotación: - Principios xerais de *dimensionamiento. - Tipos de anotación. Clasificación das cotas. - Principios de anotación. - Elementos de anotación: Liñas, extremos de liñas, *inscriciones, etc. - Formas de anotación: serie, paralelo, por coordenadas, etc. - Anotación de elementos particulares: radios, diámetros, esferas, arcos, *simetrías, *chaflanes, etc. - Roscas e unións *roscadas. Elementos dunha rosca. Elementos *roscados. Clasificación das roscas. Representación das roscas. Roscas normalizadas. - Anotación de elementos *roscados. - Designación das roscas. Debuxos de conxunto e despezamento: - Regras e convenios: referencia a elementos, materiais, numeración de planos, exemplos. - Anotación de conxuntos. Lista de despezamento. Sistemas de tolerancias: - Tipos de tolerancias: *dimensionales e xeométricas. - Tolerancias *dimensionales: lineais e angulares. - Tolerancias *ISO: calidades, posicións, tipos de axuste, etc. - Sistemas de axuste. Exemplos.

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	38	116	154
Resolución de problemas	34	0	34
Seminario	4	0	4
Aprendizaxe baseado en proxectos	0	27	27
Exame de preguntas de desenvolvemento	2	0	2
Práctica de laboratorio	4	0	4
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Sesión maxistral activa. Cada unidade temática será presentada polo profesor, complementada cos comentarios dos estudantes con base na bibliografía asignada ou outra pertinente.
Resolución de problemas	Exporanse exercicios e/ou problemas que se resolverán de maneira individual ou *grupal.

Seminario	Realización de actividades de reforzo á aprendizaxe mediante a resolución tutelada de maneira *grupal de supostos prácticos vinculados aos contidos teóricos da materia.
Aprendizaxe baseado en proxectos	Realización de actividades que requiren a participación activa e a colaboración entre os estudantes.

Atención personalizada

Methodologies	Description
Seminario	

Avaliación

	Description	Qualification	Evaluated Competencess		
Exame de preguntas de desenvolvemento	Realizarase un exame final que abarcará a totalidade dos contidos da materia, tanto teóricos como prácticos, e que poderán incluír probas tipo test, preguntas de razoamento, resolución de problemas e desenvolvemento de casos prácticos. Esíxese alcanzar unha cualificación mínima de 4,0 puntos sobre 10 posibles para poder superar a materia.	65	CG3 CG4	CE5	CT2 CT9
Práctica de laboratorio	Ao longo do cuadrimestre, en determinadas sesións de resolución de problemas e exercicios exporanse problemas ou exercicios para a súa resolución polos alumnos e posterior entrega ao profesor, que os avaliará de acordo cos criterios que con anterioridade se comunicaron aos alumnos.	35	CG4	CE5	CT2 CT6 CT9

Other comments on the Evaluation

En segunda convocatoria realizarase ao alumno unha proba teórico-práctica para avaliar o seu grao de adquisición de competencias, de características análogas ao exame final, no que para superar a materia será necesario alcanzar unha cualificación mínima de 5,0 puntos sobre 10 posibles.

Compromiso ético: *Espérase que ou alumno presente un *comportamento ético *axeitado. Non caso de detectar un *comportamento *non ético (copia, *plaxio, utilización de aparellos electrónicos *non autorizados, e *outros) *considerarase que ou alumno *non reúne vos requisitos necesarios para superar a materia. *Neste caso a *cualificación global non presente curso académico será de suspenso (0.0).
Profesores responsables de grupos:<*p>Grupo A: Javier *Corralo *Domonte.<*p>Grupo *B: Carlos *Troncoso *Saracho.<*p>Grupo *C: Antonio Fernández Álvarez.<*p>Grupo D: Carlos *Troncoso *Saracho.
Grupo *G: Ernesto Roia Curral.<*p>Grupo *H: Esteban López Figueroa.<*p>Grupo *I:&*nbsp;&*nbsp;Faustino Patiño *Barbeito.<*p>Grupo *J: Ernesto Roia Curral.<*p>Grupo *K: Manuel Adán Gómez.<*p>Grupo *L: Faustino Patiño *Barbeito.<*p>&*nbsp;

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

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

Complementary Bibliography

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

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

Auria, José M.; Ibáñez Carabantes, Pedro; Ubieto Artur, Pedro, **DIBUJO INDUSTRIAL. CONJUNTOS Y DESPIECES**, 2ª Edición, ISBN: 84-9732-390-4,

Guirado Fernández, Juan José, **INICIACIÓN Á EXPRESIÓN GRÁFICA NA ENXEÑERÍA**, ISBN: 84-95046-27-X,

Ramos Barbero, Basilio; García Maté, Esteban, **DIBUJO TÉCNICO**, 2ª Edición, ISBN: 84-8143-261-X,

Manuales de usuario y tutoriales del software DAO empleado en la asignatura,

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

David A. Madsen, David P. Madsen, **Engineering Drawing & Design**, 5ª, Delmar Cengage Learning, 2012

Recomendacións

Other comments

É recomendable para un adecuado seguimento da materia dispor de coñecementos previos de debuxo, ao nivel dos estudos cursados no Bacharelato da Opción Científico-Tecnolóxica.

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
As metodoloxías docentes se impartirán, de ser necesario, adecuándoas ós medios telemáticos que se poñan a disposición do profesorado, ademais da documentación facilitada a través de FAITIC e outras plataformas, correo electrónico, etc. Cando non sexa posible a docencia presencial, na medida do posible, primarase a impartición dos contidos teóricos por medios telemáticos así como aqueles contidos de prácticas de resolución de problemas, aula de informática, e outros, que poidan ser virtualizados ou desenvolvidos polo alumnado de xeito guiado, intentado manter a presencialidade para as prácticas experimentais de laboratorio, sempre que os grupos cumpran coa normativa establecida no momento polas autoridades pertinentes en materia sanitaria e de seguridade. No caso de non poder ser impartida de forma presencial, aqueles contidos non virtualizables se impartirán ou suplirán por outros (traballo autónomo guiado, etc.) que permitan acadar igualmente as competencias asociados a eles.

* Mecanismo non presencial de atención ao alumnado (titorías)
As titorías poderán desenvolverse indistintamente de forma presencial (sempre que sexa posible garantir as medidas sanitarias) ou telemáticas (e-mail e outros) respectando ou adaptando os horarios de titorías previstos. Asemade, farase unha adecuación metodolóxica ó alumnado de risco, facilitándolle información específica adicional, de acreditarse que non pode ter acceso ós contidos impartidos de forma convencional.

=== ADAPTACIÓN DA AVALIACIÓN ===

Información adicional sobre a avaliación: manteranse aquelas probas que xa se veñen realizando de forma telemática e, na medida do posible, manteranse as probas presenciais adecuándoas á normativa sanitaria vixente. As probas se desenvolverán de forma presencial salvo Resolución Reitoral que indique que se deben facer de forma non presencial, realizándose dese xeito a través das distintas ferramentas postas a disposición do profesorado. Aqueles probas non realizables de forma telemática se suplirán por outros (entregas de traballo autónomo guiado, etc.)
-

IDENTIFYING DATA				
Physics: Physics 1				
Subject	Physics: Physics 1			
Code	V12G363V01102			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Lusquiños Rodríguez, Fernando			
Lecturers	Álvarez Fernández, María Inés Blanco García, Jesús Boutinguiza Larosi, Mohamed Iglesias Prado, Jose Ignacio Lusquiños Rodríguez, Fernando Paredes Galán, Ángel Pérez Davila, Sara Quintero Martínez, Félix Ribas Pérez, Fernando Agustín Sánchez Vázquez, Pablo Breogán Serra Rodríguez, Julia Asunción Soto Costas, Ramón Francisco Trillo Yáñez, María Cristina			
E-mail	flusqui@uvigo.es			
Web	http://faitic.uvigo.es			
General description	(*)Física do primeiro curso das Enxeñarías da rama Industrial			

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

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

Contents
Topic

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

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

Planning

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

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

Methodologies

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

Personalized assistance

Methodologies	Description
Lecturing	In office hours

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

Assessment

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

Other comments on the Evaluation

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

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

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

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

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

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

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

G = ECL + ECA + T + P

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

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

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

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

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

Sources of information

Basic Bibliography

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

Complementary Bibliography

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

Recommendations

Other comments

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

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

* Teaching methodologies modified

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

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

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

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

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

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

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

* New tests

* Additional Information

IDENTIFYING DATA				
Mathematics: Algebra and statistics				
Subject	Mathematics: Algebra and statistics			
Code	V12G363V01103			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Luaces Pazos, Ricardo			
Lecturers	Bazarra García, Noelia Castejón Lafuente, Alberto Elias Estévez Martínez, Emilio Fiestras Janeiro, Gloria Godoy Malvar, Eduardo Gómez Rúa, María Lorenzo Picado, Leticia Luaces Pazos, Ricardo Martín Méndez, Alberto Lucio Matías Fernández, José María Rodríguez Campos, María Celia			
E-mail	rluaces@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The aim of this course is to provide the student with the basic techniques in Algebra and Statistics that will be necessary in other courses of the degree. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE1	CE1 Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.
CT2	CT2 Problems resolution.
CT5	CT5 Information Management.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Apply knowledge.

Learning outcomes	Competences			
Acquire the basic knowledge on matrices, vector spaces and linear maps.	CB2	CG1 CG2 CG3	CE1 CE20 CE22	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	CB4	CG1 CG2 CG3	CE1 CE22	CT2 CT5 CT8
Understand the basic concepts on eigenvalues and eigenvectors, vector spaces with scalar product and quadratic forms used in other courses and sove basic problems related to these subjects.		CG2 CG3 CG9 CG14 CG15	CE1 CE1 CE2 CE3 CE4	CT1 CT2 CT2 CT3 CT4 CT5 CT6 CT9

Perform basic exploratory analysis of databases.		CG1 CG2 CG3 CG9 CG10 CG11 CG12 CG13 CG14	CE1 CE1 CE5 CE6 CE7 CE9 CE10 CE13 CE14 CE15 CE16	CT1 CT2 CT3 CT4 CT5 CT5
Model situations under uncertainty by means of probability.	CB1	CG3 CG3	CE1 CE1	CT2 CT2
Know basic statistical models and their application to industry and perform inferences from data samples.	CB1 CB2	CG3 CG4 CG6	CE1 CE7 CE8	CT1 CT2 CT2 CT9
Use computer tools to solve problems of the contents of the course.	CB2 CB3	CG3 CG3 CG4	CE1 CE7 CE13 CE14 CE16 CE17 CE18	CT1 CT2 CT3 CT4 CT6 CT10

Contents

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

Planning

	Class hours	Hours outside the classroom	Total hours

Lecturing	40	81	121
Problem solving	12	12	24
Laboratory practical	24	12	36
Autonomous problem solving	0	40	40

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

Methodologies

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

Personalized assistance

Methodologies	Description
Laboratory practical	
Lecturing	
Problem solving	
Autonomous problem solving	

Assessment

	Description	Qualification	Evaluated Competencess		
Problem solving	Students will make several mid-term exams of Algebra and Statistics during the course.	40 por cento en Álxebra; 20 por cento en Estatística	CG3	CE1	CT2 CT5 CT6 CT9

Other comments on the Evaluation

At the end of the first quarter, once the mid-term exams and the final exams have been done, the student will have a grade out of 10 points in Algebra (A) and a grade out of 10 points in Statistics (S). The final qualification of the subject will be calculated as follows: - If both grades, A and S, are greater or equal to 3.5, then the final grade will be (A+S)/2. - Any of the grades A or S is less than 3.5, then the final qualification will be the minimum of the quantities (A+S)/2 and 4.5. The students who are exempted by the School from taking the mid-term exams will be evaluated through a final exam of Algebra (100% of the grade of this part) and a final exam of Statistics (100% of the grade of this part). The final grade will be calculated according to procedure described above. A student will be assigned to NP ("absent") if he/she is absent in both final exams (i.e. Algebra and Statistics); otherwise he/she will be graded according the the procedure described above. The assessment in the second call (June/July) will be done by means of a final exam of Algebra and a final exam of Statistics (100% of the grade of each part). The final grade will be calculated according to procedure described above. If at the end of the first quarter a student obtains a grade equal to or greater than 5 out of 10 in any of the parts of the subject (Algebra or Statistics) then he/she will keep this grade in the second call (June/July) without retaking the corresponding exam. Ethical commitment: Students are expected to commit themselves to an adequate and ethical behaviour. Students showing unethical behaviours (exam cheating, plagiarism, unauthorized use of electronic devices, etc.) will be rated with the minimum grade (0.0) in the current academic year. As a general rule, the use of any electronic device for the assessment tests is not allowed unless explicitly authorized. Responsible lecturers by group: Group A: Eduardo Godoy Malvar / Gloria Fiestras Janeiro Group B: Alberto Martín Méndez / José María Matías Fernández Group C: Alberto Castejón Lafuente / José María Matías Fernández Group D: Cecilio Fonseca Bon / Celia Rodríguez Campos Group G: José Ramón Fernández García / María Gómez Rúa Group H: José Ramón Fernández García / Ricardo Luaces Pazos Group I: Cecilio Fonseca Bon / Juan Carlos Pardo Fernández Group J: Eduardo Martínez Brey / Ricardo Luaces Pazos Group K: Cecilio Fonseca Bon / José María Matías Fernández Group L: Alberto Castejón Lafuente / Leticia Lorenzo Picado

Sources of information

Basic Bibliography

Complementary Bibliography

Lay, David C., **Álgebra lineal y sus aplicaciones**, 4ª,

Nakos, George; Joyner, David, **Álgebra lineal con aplicaciones**, 1ª,

de la Villa, A., **Problemas de álgebra**, 4ª,
Cao, Ricardo et al., **Introducción a la Estadística y sus aplicaciones**, 1ª,
Devore, Jay L., **Probabilidad y estadística para ingeniería y ciencias.**, 8ª,
Devore, Jay L., **Probability and statistics for engineering and sciences**, 8ª,

Recommendations

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus I/V12G380V01104

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

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

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

IDENTIFYING DATA				
Matemáticas: Cálculo I				
Subject	Matemáticas: Cálculo I			
Code	V12G363V01104			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	1c
Teaching language	Castelán Galego			
Department	Matemática aplicada I Matemática aplicada II			
Coordinator	Martínez Martínez, Antonio			
Lecturers	Díaz de Bustamante, Jaime Estévez Martínez, Emilio Martín Méndez, Alberto Lucio Martínez Martínez, Antonio Martínez Torres, Javier Prieto Gómez, Cristina Magdalena Rodal Vila, Jaime Alberto Vidal Vázquez, Ricardo			
E-mail	antonmar@uvigo.es			
Web	http://faitic.uvigo.es			
General description	O obxectivo desta materia é que o estudante adquira o dominio das técnicas básicas de cálculo diferencial nunha e en varias variables e de cálculo integral nunha variable que son necesarias para outras materias que debe cursar na titulación.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE1	CE1 Capacidade para a resolución dos problemas matemáticos que poidan presentarse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
CT1	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.
CT14	CT14 Creatividade.
CT16	CT16 Razoamento crítico.

Resultados de aprendizaxe				
Learning outcomes	Competences			
Comprensión dos coñecementos básicos de cálculo diferencial dunha e de varias variables.	CB2 CB3 CB4	CG1 CG2 CG3 CG3 CG5 CG6 CG7	CE1 CE1 CE2 CE3 CE4 CE5 CE6 CE7	CT1 CT2 CT3 CT4 CT5 CT6 CT7 CT8 CT10
Comprensión dos coñecementos básicos de cálculo integral de funcións dunha variable.	CB4	CG3 CG6	CE1 CE6	CT1 CT1
Manexo das técnicas de cálculo diferencial para a localización de extremos, a aproximación local de funcións e a resolución numérica de sistemas de ecuacións.		CG3 CG3 CG4	CE1 CE2	CT2 CT2 CT9 CT10 CT14 CT16

Manexo das técnicas de cálculo integral para o cálculo de áreas, volumes e superficies.	CG3 CG3 CG4	CE1 CE1	CT1 CT1 CT2 CT9 CT14 CT16
Utilización de ferramentas informáticas para resolver problemas de cálculo diferencial e de cálculo integral.	CG3 CG4	CE1 CE1	CT2 CT2 CT6 CT9 CT16

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

Planificación

	Class hours	Hours outside the classroom	Total hours
Resolución de problemas	20.5	30	50.5
Prácticas de laboratorio	12.5	5	17.5
Lección maxistral	32	39	71
Resolución de problemas e/ou exercicios	3	3	6
Exame de preguntas de desenvolvemento	2	3	5

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

Metodoloxía docente

	Description
Resolución de problemas	O profesor resolverá problemas e exercicios tipo e o alumno terá que resolver exercicios similares.
Prácticas de laboratorio	Empregaranse ferramentas informáticas para resolver exercicios e aplicar os coñecementos obtidos nas clases de teoría.
Lección maxistral	O profesor exporá nas clases teóricas os contidos dá a materia.

Atención personalizada

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

Avaliación

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

Other comments on the Evaluation

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

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

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

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

Burgos, J., **Cálculo Infinitesimal de varias variables**, 2ª, McGraw-Hill, 2008

Galindo Soto, F. y otros, **Guía práctica de Cálculo Infinitesimal en una variable**, 1ª, Thomson, 2003

Galindo Soto, F. y otros, **Guía práctica de Cálculo Infinitesimal en varias variables**, 1ª, Thomson, 2005

Larson, R. y otros, **Cálculo 1**, 9ª, McGraw-Hill, 2010

Larson, R. y otros, **Cálculo 2**, 9ª, McGraw-Hill, 2010

Stewart, J., **Cálculo de una variable. Trascendentes tempranas**, 7ª, Thomson Learning, 2014

Complementary Bibliography

García, A. y otros, **Cálculo I**, 3ª, CLAGSA, 2007

García, A. y otros, **Cálculo II**, 2ª, CLAGSA, 2006

Rogawski, J., **Cálculo. Una variable**, 2ª, Reverte, 2012

Rogawski, J., **Cálculo. Varias variables**, 2ª, Reverte, 2012

Tomeo Perucha, V. y otros, **Cálculo en una variable**, 1ª, Garceta, 2011

Tomeo Perucha, V. y otros, **Cálculo en varias variables**, 1ª, Garceta, 2011

Recomendacións

Subjects that continue the syllabus

Matemáticas: Cálculo II e ecuacións diferenciais/V12G330V01204

Subjects that are recommended to be taken simultaneously

Matemáticas: Álxebra e estatística/V12G330V01103

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

= === ADAPTACIÓN DE LAS METODOLOGÍAS Y EVALUACIÓN ===

Si la situación sanitaria lo requiere,

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

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

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

IDENTIFYING DATA				
Business: Introduction to business management				
Subject	Business: Introduction to business management			
Code	V12G363V01201			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Álvarez Llorente, Gema			
Lecturers	Álvarez Llorente, Gema Arevalo Tomé, Raquel Fernández Arias, Mª Jesús López Miguens, María Jesús Pérez Pereira, Santos Sinde Cantorna, Ana Isabel Somoza Alonso, Elena Urgal González, Begoña			
E-mail	galvarez@uvigo.es			
Web	http://faitic@uvigo.es			
General description	(*)Esta materia ten como obxectivo fundamental ofrecer ao alumno unha visión preliminar ou introdutoria, de carácter teórico-práctico, encol a natureza e o funcionamento das organizacións empresariais e a súa relación coa contorna na que operan, así como as actividades que levan a cabo. Para iso, entre outras cousas, definiremos o termo empresa dende un punto de vista multidimensional que abrangue a complexidade do seu funcionamento como sistema aberto. Posteriormente, analizaremos as relacións da empresa coa súa contorna, e entraremos no estudo das súas principais áreas funcionais que contribúen ao correcto desenvolvemento da súa actividade.			

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

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

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

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32.5	45.5	78
Laboratory practical	18	45	63
Objective questions exam	3	6	9
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

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

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

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

Other comments on the Evaluation

1. Ethical commitment:

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

(0.0).

2. Continuous evaluation system

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

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

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

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

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

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

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

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

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

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

It will be understood that a student has opted for continuous assessment when, fulfilling the necessary requirements

regarding the completion of practices, participates in the second test type test.

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

3. Students who do not opt for continuous assessment

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

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

4. About the July call

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

5. Prohibition of the use of electronic devices

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

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Basics of operations management/V12G320V01605

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

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

guides.

=== ADAPTATION OF THE METHODOLOGIES ===

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

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

=== ADAPTATION OF THE TESTS ===

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

1. CONTINUOUS ASSESMENT

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

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

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

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

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

2. NON-CONTINUOUS ASSESSMENT

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

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

3. NON ORDINARY EXAM IN JUYLY

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

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

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

IDENTIFYING DATA				
Physics: Physics 2				
Subject	Physics: Physics 2			
Code	V12G363V01202			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Fernández, José Luís			
Lecturers	Álvarez Fernández, María Inés Blanco García, Jesús Fernández Fernández, José Luís López Vázquez, José Carlos Lusquiños Rodríguez, Fernando Méndez Morales, Trinidad Paredes Galán, Ángel Quintero Martínez, Félix Ribas Pérez, Fernando Agustín Sánchez Vázquez, Pablo Breogán Soto Costas, Ramón Francisco Val García, Jesús del Wallerstein Figueirôa, Daniel			
E-mail	jlfdez@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This undergraduate course is the second quarter of introductory physics. The focus is on electricity, magnetism and thermodynamics			

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

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

Contents	
Topic	
1.- ELECTRIC CHARGE AND ELECTRIC FIELD	1.1.- Electric Charge. 1.2.- Conductors, Insulators and Induced Charges. 1.3.- Coulomb□s Law. 1.4.- Electric Field and Electric Forces. 1.5.- Electric Field Calculations. 1.6.- Electric Field Lines. 1.7.- Electric Dipoles.

2.- GAUSS'S LAW	2.1.- Charge and Electric Flux. 2.2.- Calculating Electric Flux. 2.3.- Gauss's Law. 2.4.- Applications of Gauss's Law. 2.5.- Conductors in Electrostatic Equilibrium.
3.- ELECTRIC POTENTIAL	3.1.- Electric Potential Energy. 3.2.- Electric Potential. 3.3.- Calculating Electric Potential. 3.4.- Equipotential Surfaces. 3.5.- Potential Gradient.
4.- CAPACITANCE AND DIELECTRICS	4.1.- Capacitors and Capacitance. 4.2.- Capacitors in Series and Parallel. 4.3.- Energy Storage in Capacitors and Electric-Field Energy. 4.4.- Dielectrics, Molecular Model of Induced Charge, and Polarization Vector. 4.5.- Gauss's Law in Dielectrics. 4.6.- Dielectric Constant and Permittivity.
5.- CURRENT, RESISTANCE, AND ELECTROMOTIVE FORCE	5.1.- Electric Current. 5.2.- Current and Current Density. 5.3.- Ohm□s Law and Resistance. 5.4.- Electromotive Force and Circuits. 5.5.- Energy and Power in Electrical Circuits. 5.6.- Basic Theory of Electrical Conduction.
6.- MAGNETIC FIELD	6.1.- Magnetic Field. 6.2.- Motion of Charged Particles in a Magnetic Field. 6.3.- Magnetic Force on a Current-Carrying Conductor. 6.4.- Force and Torque on a Current Loop. 6.5.- Biot-Savart□s Law. 6.6.- Magnetic Field Lines and Magnetic Flux. 6.7.- Ampère□s Law.
7.- MAGNETIC FIELD IN MATTER	7.1.- Magnetic Substances and Magnetization Vector. 7.2.- Ampère□s Law in Magnetic Media. 7.3.- Magnetic Susceptibility and Permeability. 7.4.- Paramagnetism and Diamagnetism. 7.5.- Ferromagnetism.
8.- ELECTROMAGNETIC INDUCTION	8.1.- Induction Experiments. 8.2.- Faraday-Lenz's Law. 8.3.- Induced Electric Fields. 8.4.- Eddy Currents. 8.5.- Mutual Inductance. 8.6.- Self-Inductance and Inductors. 8.7.- Magnetic-Field Energy.
9.- THERMODYNAMIC SYSTEMS	9.1.- Classical Thermodynamics. 9.2.- Thermodynamic Systems and Classification. 9.3.- State Variables and State of a System. 9.4.- Equations of State. 9.5.- Thermodynamic Equilibrium. 9.6.- Change of State, Transformation or Process. 9.7.- Quasi-static Processes. 9.8.- State and Process Functions.
10.- TEMPERATURE AND HEAT	10.1.- Thermal Equilibrium, The Zeroth Law of Thermodynamics, and Temperature. 10.2.- Thermometers and Temperature Scales. 10.3.- Ideal Gas Thermometers and the Kelvin Scale. 10.4.- Heat. 10.5.- Calorimetry and Heat Capacities.
11.- THE FIRST LAW OF THERMODYNAMICS	11.1.- Work. 11.2.- Work Done During Volume Changes. 11.3.- Internal Energy. 11.4.- The First Law of Thermodynamics. 11.5.- Internal Energy of an Ideal Gas. 11.6.- Molar Heat Capacities of an Ideal Gas. 11.7.- Adiabatic, Isothermal, Isobaric and Isochoric Processes for an Ideal Gas. 11.8.- Enthalpy.

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

Planning

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

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

Methodologies

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

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

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

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

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

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

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

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

Final mark G for the continuous assessment modality:

G = ECL + ECA + T + P.

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

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

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

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

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

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

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

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

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

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

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

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

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

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

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

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

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

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

Recommendations

Other comments

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

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

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

* Modifications (if applicable) of the contents
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* Additional bibliography to facilitate self-learning
--

* Other modifications
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=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
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* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
Final exam, part P 40%, the weight of the exam is maintained.
Final exam, part T 20%, the weight of the exam is maintained.

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

* New tests
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* Additional Information
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IDENTIFYING DATA				
Computer science: Computing for engineering				
Subject	Computer science: Computing for engineering			
Code	V12G363V01203			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Rodríguez Diéguez, Amador Rodríguez Damian, María			
Lecturers	Ibáñez Paz, Regina Moares Crespo, José María Pérez Cota, Manuel Rodríguez Damian, Amparo Rodríguez Damian, María Rodríguez Diéguez, Amador Sáez López, Juan Sanz Dominguez, Rafael Vázquez Núñez, Fernando Antonio			
E-mail	mrdamian@uvigo.es amador@uvigo.es			
Web	http://faitic.uvigo.es			
General description	They treat the following contents: Methods and basic algorithms of programming Programming of computers by means of a language of high level Architecture of computers Operating systems basic Concepts of databases English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

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

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

Database fundamentals	CG3	CE3	CT1 CT5 CT6 CT7
Capability to implement simple algorythims using a programming language	CG3 CG4	CE3	CT2 CT7 CT17
Structured and modular programming fundamentals	CG3 CG4	CE3	CT2 CT5 CT17

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Laboratory practical	22	30	52
Case studies	12	14	26
Lecturing	8	12	20
Objective questions exam	4	7	11
Laboratory practice	6	8	14
Essay questions exam	10	15	25
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Introductory activities	Activities related to estashing contact, gathering information from the students, organizing groups, as well as presenting the course.
Laboratory practical	Activities related to applying the knowledge obtained to specific situations and acquiring basic and procedimental skills related with the subject being studied. Developed in specialized spaces with specialized equipment (labs, computer rooms, etc).
Case studies	Analyze a fact, problem or real event with the purpose of knowing it, interpreting it, resolving it, generating hypothesis, contrasting data, thinking about it, gaining new knowledge, diagnosing it and training alternative solutions
Lecturing	Exhibition of the contents that make up the subject being studied on behalf of the profesor, theoretical principles and/or instructions regarding an assignment, exercise or project to be developed by the student.

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

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

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

Other comments on the Evaluation

Ethical commitment:

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

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

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

CONTINUOUSASSESSMENT OPERATION

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

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

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

First call (May/June):

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

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

Second call (June/July):

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

NON-CONTINUOUS EVALUATION OPERATION

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

First call (May/June):

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

Second call (June/July):

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

Sources of information

Basic Bibliography

Eric Matthes, **Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming**, 2019

Sébastien Chazallet, **Python 3. Los fundamentos del lenguaje - 2ª edición**, 2016

Dictino Chaos García, **Introducción a la informática básica (GRADO)**, 2017

Complementary Bibliography

Tanenbaum, Andrew S.,, **Sistemas Operativos Modernos**, Pearson Education, 2009

Silberschatz, Abraham ,Korth Henry, Sudarshan, S.,, **Fundamentos de bases de datos**, McGraw-Hill,, 2014

Recommendations

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===

=== ADAPTATION OF THE METHODOLOGIES ===

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

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

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

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

=== ADAPTATION OF THE EVALUATION ===

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

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

IDENTIFYING DATA				
Matemáticas: Cálculo II e ecuacións diferenciais				
Subject	Matemáticas: Cálculo II e ecuacións diferenciais			
Code	V12G363V01204			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1	2c
Teaching language	Castelán Galego Inglés			
Department	Matemática aplicada I Matemática aplicada II			
Coordinator	Cachafeiro López, María Alicia			
Lecturers	Bazarra García, Noelia Cachafeiro López, María Alicia Calvo Ruibal, Natividad Castejón Lafuente, Alberto Elias Durany Castrillo, José Fernández García, José Ramón Godoy Malvar, Eduardo Martínez Brey, Eduardo Martínez Torres, Javier			
E-mail	acachafe@uvigo.es			
Web	http://faitic.es			
General description	U obxectivo que se persegue con esta asignatura é que o alumno coñeza as técnicas básicas de o cálculo integral en varias variables, cálculo vectorial, ecuaciones diferenciales ordinarias e as súas aplicacións.			

Competencias	
Code	
CG3	CG3 Coñecemento en materias básicas e tecnolóxicas, que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
CG4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
CE1	CE1 Capacidade para a resolución dos problemas matemáticos que poidan presentarse na enxeñaría. Aptitude para aplicar os coñecementos sobre: álxebra lineal; xeometría; xeometría diferencial; cálculo diferencial e integral; ecuacións diferenciais e en derivadas parciais; métodos numéricos; algorítmica numérica; estatística e optimización.
CT1	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT3	CT3 Comunicación oral e escrita de coñecementos na lingua propia.
CT6	CT6 Aplicación da informática no ámbito de estudo.
CT9	CT9 Aplicar coñecementos.
CT15	CT15 Obxectivación, identificación e organización.
CT16	CT16 Razoamento crítico.

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

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

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

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	32	60	92
Resolución de problemas	22	24	46
Prácticas de laboratorio	9	0	9
Exame de preguntas de desenvolvemento	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

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

Atención personalizada

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

Avaliación

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

Other comments on the Evaluation

A avaliación continua consistirá na realización de probas escritas e/ou traballos, os cales terán un peso do 40% na nota por avaliación continua, sendo o peso do exame final do 60%. A cualificación final do alumno será a mellor nota entre a obtida mediante avaliación continua e a obtida no exame final.

A avaliación dos alumnos en segunda convocatoria consistirá nun exame sobre os contidos da materia que suporá o 100% da nota.
Compromiso ético:Espérase que o alumno presente un comportamento ético adecuado. En caso de detectar un comportamento non ético (por exemplo, copia, plaxio, utilización de aparellos electrónicos non autorizados) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global da materia no presente curso académico será de suspenso con cualificación numérica de 0.

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

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

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

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

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

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

Complementary Bibliography

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

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

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

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

IDENTIFYING DATA				
Chemistry: Chemistry				
Subject	Chemistry: Chemistry			
Code	V12G363V01205			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Cruz Freire, José Manuel			
Lecturers	Álvarez Álvarez, María Salomé Bolaño García, Sandra Bravo Bernárdez, Jorge Canosa Saa, Jose Manuel Cruz Freire, José Manuel Lorenzo Fernández, Paula Mandado Alonso, Marcos Meijide Fernández, Jéssica Moldes Moreira, Diego Mosquera Castro, Ricardo Antonio Nóvoa Rodríguez, Ramón Rey Losada, Francisco Jesús Rodríguez Rodríguez, Ana María Rosales Villanueva, Emilio Souto Salgado, José Antonio			
E-mail	jmcruz@uvigo.es			
Web	http://faitic.uvigo.es/			
General description	This is a basic subject, common for all levels of the industrial fields studies. At the end of the course the students will have a basic knowledge about the principles of general chemistry, organic chemistry and inorganic chemistry, and its application to Industry. This knowledge will be further applied and expanded in other areas of the studies.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
CT2	CT2 Problems resolution.
CT3	CT3 Oral and written proficiency in the own language.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes			
Learning outcomes	Competences		
Knowing the chemical bases of industrial technologies. Specifically, the student will gain basic knowledge of general, organic and inorganic chemistry and their applications in engineering. This will allow the student to apply the basic concepts and fundamental laws of chemistry. Due to theoretical-practical training, the student will be able to effectively carry out lab experiments and to solve basic chemistry exercises.	CG3 CE4 CT2 CT3 CT10 CT17		

Contents
Topic

1. Atomic theory and chemical bonding	1.1 Atomic theory: Particles of the atom: Electron, proton et neutron. Characteristics of the atom: Atomic number and Atomic mass. Isotopes. Stability of the nucleus: Radioactivity (natural and artificial). Evolution of the atomic theory. 1.2. Chemical bonding: Definition. Intramolecular bonding: Covalent bonding and ionic bonding. Polyatomic molecules: hybridization and delocalization of electrons. Intermolecular bonding: Types of intermolecular forces.
2. States of aggregation: Solids, gases, pure liquids and solutions	2.1. Solid state: Introduction. Classification of solids: amorphous solids, molecular crystals and liquid crystals, Covalent crystals and ionic crystals. 2.2. Gaseous state: Characteristics of the gas phase. Ideal gases: Equation of state. Real gases: Equation of state. Properties of gases. 2.3. Liquid state: Characteristics of the liquid phase: physical properties (density, surface tension, viscosity). Changes of state. Phase diagram. Solutions: colligative properties
3. Thermochemistry	3.1. Heat of reaction: Definition of Enthalpy and Internal Energy. Enthalpy of reaction. Temperature Dependence of Enthalpy Changes. Enthalpy of formation. Determination of the reaction enthalpy: direct method. State Function and Hess's Law. 3.2. Entropy: Definition. Calculus. 3.3. Free energy: Definition. Calculus. The Criterion of Evolution.
4.Chemical equilibrium: in gas phase, acid-base-base, redox, solubility	(4.1. Chemical equilibrium: Concept of Equilibrium. Equilibrium Constant. Types of equilibrium. The Le Chatelier Principe. 4.2. Acid-base Equilibrium: Definition of acid and base. Autoionization of water. Ionic Product. Concept of pH and pOH. Strength of acids and bases: Polyprotic acids. Amphoters. pH calculation. Acid-base titration. Buffer solutions. 4.3. Redox equilibrium: Concept of oxidation, reduction, oxidising agent, reducing agent. Balance of redox reactions in acid and alkaline media. Redox titration. Electrochemical cells: basic concepts and redox potential. Thermodynamics of electrochemical reactions: Gibbs Energy and cell Potential. Nernst Equation. Faraday□s Laws. 4.4 Solubility equilibrium: Soluble salts: Hydrolysis. Sparingly soluble salts: solubility and solubility product. Factors affecting solubility. Fractional Precipitation. Complex Salts: Definition, properties, dissociation and importance.
5. Chemical kinetics	5.1. Basic Concepts: Reaction Rate. Reaction Order. Kinetic Constant. Rate Equation. 5.2. Determination of the Rate Equation: Initial rate method. Integrated Rate Laws. 5.3. Factors affecting the Reaction Rate.
6. Basic principles of Organic Chemistry	6.1. Fundamentals of Organic formulation and functional groups: 6.1.1. ºStructure of the organic compounds: Alkanes, alkenes and alkynes. Aromatic Hydrocarbons. 6.1.2. Alcohols and phenols. 6.1.3. Ethers. 6.1.4. Aldehydes and ketones. 6.1.5. Esters. 6.1.6. Carboxylic acids and derivatives. 6.1.7. Amines and nitro-compounds.
7. Basic principles of Inorganic Chemistry.	7.1. Metallurgy and the Chemistry of Metals: Abundance of metals. Nature of the metallic bond, properties. Theory of the Conduction Band: conducting materials, semiconductors and superconductors. Metallurgical processes: iron and steel. 7.2. Non-metallic elements and their compounds: General properties. Hydrogen. Carbon. Nitrogen and phosphorous. Oxygen and sulphur. Halogens.

8. Applied Electrochemistry	8.1. Applications of the Nernst equation: Determination of pH, Equilibrium constant, solubility product. 8.2. Electrochemical cells: types of cells. Concentration Cells. Electric Conductivity in electrolytes. Electrolysis Cells. 8.3. Industrial Processes of electrolysis: electrodeposition (electroplating), electrometallurgy, electrolysis chlorine□caustic soda. Fuel cells.
9. Corrosion and treatment of Surfaces	9.1. Basic principles of Corrosion: the corrosión cell. 9.2. Corrosion of metals. 9.3. Corrosion rate. 9.4. Types of Corrosion. 9.5. Protection against Corrosion: Design considerations for Corrosion protection. Cathodic protection: sacrificial anodes and impressed current. Organic Coatings. Metallic coatings.
10. Electrochemical sensors	10.1. Fundamentals. 10.2. Typology and function. 10.3. Conductivity Sensors. 10.4. Potentiometric Sensors. 10.5. Ion Selective electrodes. pH sensors. 10.6. Sensors for gases in solution. 10.7. Enzyme-based sensors: Biosensors. 10.8. Amperometric and voltammetric sensors. 10.9. Applications of sensors: medicine, industry, environment.
11. Petroleum and derivatives. Petrochemistry	11.1. Physicochemical characteristics of petroleum (oil). 11.2. Physicochemical characteristics of natural gas. 11.3. Conditioning and uses of natural gas. 11.4. Fractioning of oil. 11.5. Cracking of hydrocarbons. Reforming, isomerisation, oligomerisation, alkylation and esterification of hydrocarbons. 11.6. Petrochemical processes of BTX; olefins and derivatives; methanol and derivatives. 11.7. Treatment of sulphurous compounds and refining units.
12. Carbon: Carbochemistry	(12.1. Formation of carbon. 12.2. Types of carbons and their constitution. 12.3. Technological uses of carbon. 12.4. Pyrogenation of carbon. 12.5. Hyidrogenation of carbon. 12.6. Direct liquefaction of carbon. Gasification.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	45	75
Problem solving	7.5	12	19.5
Laboratory practical	10	7.5	17.5
Autonomous problem solving	0	25.5	25.5
Objective questions exam	1	0	1
Problem and/or exercise solving	3	0	3
Report of practices, practicum and external practices	1	7.5	8.5

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

Methodologies

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

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Autonomous problem solving	Students must solve independently, and periodically submit problems or exercises formulated by the faculty member. The results and the procedure followed in the execution will be evaluated. According to current legislation, the final grade will be numeric and between 0 and 10.	10	CG3	CE4	CT2 CT3 CT10
Objective questions exam	The purpose of these tests, which will be carried out in the date of the official announcement of examinations, is to assess the level of theoretical knowledge acquired by students in classroom sessions. Written tests are multiple choices, multiple responses, in which students can achieve a numerical score between 0 and 10, according to current legislation.	40	CG3	CE4	CT10
Problem and/or exercise solving	The evaluation of the knowledge gained by students in seminars will be through a written exam, in the official announcement of examinations, in which the student must solve 4 or 5 problems related to the subject under study. The exam will be graded according to the current legislation, with a numerical final grade between 0 and 10.	40	CG3	CE4	CT2 CT3 CT10
Report of practices, practicum and external practices	After each laboratory session, the student should answer an oral question or prepare a detailed report including aspects such as objective and theoretical foundations, procedure followed, materials used, results and interpretation. The aspects considered in the evaluation are the content of the report, the understanding of the work done, the ability of summarising, quality of presentation, and the personal contribution. The final score, between 0 and 10, will be the average of the marks obtained in the various reports made and/or writing or oral test that could be done for each practice.	10		CE4	CT3 CT17

Other comments on the Evaluation

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

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

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

Ethical commitment:

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

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

Sources of information

Basic Bibliography

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

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Reboiras, M.D., **Problemas resueltos de de Química. La ciencia básica**, Ed. Thomson,
Fernández, M. R. y col., **1000 Problemas de Química General**, Ed. Everest,

Complementary Bibliography

Atkins, P. y Jones, L, **Principios de Química. Los caminos del descubrimiento**, Ed. Interamericana,
Herranz Agustin, C, **Química para la ingeniería**, Ediciones UPC,
McMurry, J.E. y Fay, R.C, **Química General**, Ed. Pearson,
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Herrero Villén, M.A., Atienza Boronat, J.A., Nogera Murray, P. y Tortajada Genaro, L.A., **La Química en problemas. Un enfoque práctico**, Ediciones UPV,
Sánchez Coronilla, A., **Resolución de Problemas de Química**, Ed. Universidad de Sevilla,
Brown, L.S., Holme, T.A., **Chemistry for engineering students**, Brooks/Cole Cengage Learning, 3rd ed.,

Recommendations

Subjects that it is recommended to have taken before

(*)Física: Física I/V12G350V01102
(*)Matemáticas: Álxebra e estatística/V12G350V01103
(*)Matemáticas: Cálculo I/V12G350V01104

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===

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

=== ADAPTATION OF THE METHODOLOGIES ===

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

=== ADAPTATION OF THE EVALUATION ===

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

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

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

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

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

IDENTIFYING DATA				
Materials science and technology				
Subject	Materials science and technology			
Code	V12G363V01301			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Pena Uris, Gloria María			
Lecturers	Díaz Fernández, Belén Pena Uris, Gloria María			
E-mail	gpena@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The main objective of this subject is to introduce the student to Materials Science and its applications in Engineering			

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

Learning outcomes	Competences		
Understand the main concepts about chemical bonds, structure and microstructure of different types of materials	CG3	CE9	CT10
Understand the relationship between microstructure and properties (mechanical, electrical, thermal and magnetic) in a material	CG3	CE9	
Understand the mechanical performance of metallic, ceramic, plastic and composite materials.	CG4 CG6		
Know the possibilities of modification of material properties through mechanical processing and thermal treatment	CG4	CE9	CT9
Know the main techniques for materials characterization	CG3 CG6	CE9	
Acquire abilities in handling materials diagrams and charts			CT1
Acquire abilities in undertaking standardized tests on materials, under supervision	CG6	CE9	CT10
Analysis of the obtained results and draw conclusions from them			CT1 CT5 CT9
Competence to apply standards to materials testing	CG6		CT1 CT9

Contents	
Topic	
Introduction	Introduction Material Science and Technology. Materials Classification. Terminology. Course Syllabus (course content, goals, guidelines...)
Crystal strucutre	Crystalline and non-crystalline solids. Crystal systems: characteristics and imperfections. Diffusion. Allotropic transformations.

Properties of materials. Laboratory sessions.	Mechanical, chemical, thermal, electric and magnetic properties. Standars for materials testing. Compressive and tensile behaviour. Principles of fracture: mechanisms. Toughness. Hardness. Main test methods. Fundamentals of thermal analysis. Fundamentals of non-destructive testing. Introduction to metallography: monophasic and biphasic structures. Matrix and disperse constituents. Approach, proposal and resolution of exercises and/or practical cases related to each material test.
Metallic materials.	Solidification. Alloys. Grain size. Main binary phase diagrams. Processing. Carbon steels: classification and applications. Cast iron alloys. Heat treatments: aims, fundamentals and classification. Annealing, normalizing, quenching and tempering. Nonferreous alloys.
Polymers and composites	Classification based on molecular structure. Thermoplastics , thermosets and elastomers. Properties and testing methods. Processing. Classification of composite materials. Introduction to composite materials.
Ceramic materials	Classification and properties. Traditional glasses and ceramics. Advanced ceramics. Cements: phases, types and main applications. Concrete.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1.5	0	1.5
Lecturing	31	55.8	86.8
Laboratory practical	18	18	36
Autonomous problem solving	0	12	12
Objective questions exam	0.5	0.5	1
Problem and/or exercise solving	1	0.95	1.95
Problem and/or exercise solving	1.25	1.5	2.75
Essay	0.5	7.5	8

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

Methodologies

	Description
Introductory activities	Presentation of the course. Introduction to materials science and technology.
Lecturing	Explanation of the main contents of the course by the teachers. Introduction of the basis and projects guidelines of the group work. Hands on science methodology.
Laboratory practical	Practical application of the contents covered on the lecture sessions of Materials Science and Tecnology. Practical exercises in the materials laboratory.
Autonomous problem solving	Students must be able to direct their own learning and acquire problem-solving ability

Personalized assistance

Methodologies	**Description**
Lecturing	In the tutoring hours, the teacher will solve the doubts that the student may have related to this activity
Laboratory practical	In the tutoring hours, the teacher will solve the doubts that the student may have related to this activity
Tests	**Description**
Problem and/or exercise solving	In the tutoring hours, the teacher will solve the doubts that the student may have related to this activity
Essay	In the tutoring hours, the teacher will solve the doubts that the student may have related to this activity

Assessment

	Description	Qualification	Evaluated Competencess

Laboratory practical	Attendance, participation and periodical assignments.	2	CG3 CG6	CE9	CT1 CT9 CT10
Problem and/or exercise solving	In the final exam, short questions will be included. The final exam will be hold the day fixed by the school.	40	CG3 CG4 CG6	CE9	CT1 CT9 CT10
Problem and/or exercise solving	Exercises will be assessed along the course (20%). The final exam will include similar exercises (30%).	50	CG3 CG4 CG6	CE9	CT1 CT9 CT10
Essay	The main guidelines to successfully develop short projects will be given.	8	CG3 CG4 CG6	CE9	CT1 CT9 CT10

Other comments on the Evaluation

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

Final Exam: Will consist of a written test weighed 70% of the course grade, that will be taken on the official date set by the EEI direction.

Requirements to pass the course:

1- To get a minimum mark of 40% in the final exam, that is: 2.8 / 7 points and

2- The sum of the continuous assessment mark and the written tests has to be get a minimum or 50%, that is, 5/10 points.

If these requirements are not met, the student will be deemed to have failed the course, and final grade for the course will be that obtained in the written exam.

Renouncing continuous assessment: Students that do not follow the continuous assessment activities, after receiving authorization from the EEI direction, will be evaluated with a single final exam on the contents of all the course, both lecture and labo items, weighing 100%, 10 points. A minimum mark of 5 (50%) will be required to pass the course.

July exam (2nd Edition): In the July edition, the continuous assessment marks will be also considered (Valid only in course 2020-21). The characteristics of the exam will be the same as the first edition, and will be taken on the official date set by the EEI direction.

Extraordinary Call: The extraordinary call exam contents will cover the entire course, both lecture and labo items, weighing 100%, 10 points. A minimum mark of 5 (50%) will be required to pass the course.

Ethical commitment: Students are expected to carry out their work in accordance with an appropriate ethical behaviour. If the professor detects a behaviour that constitutes academic dishonesty (cheating, plagiarism, use of unauthorized electronic devices, for example) the student will be deemed not to meet all the criteria to pass the course, and will be informed that the final grade of this course will be FAIL (0.0).

The use of any electronic device will not be allowed during the evaluation tests, unless expressly authorized. Introducing an unauthorized electronic device into the exam room will be considered reason enough for not passing the course in the present academic year, and the final grade will be: FAIL (0.0).

Sources of information

Basic Bibliography

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Askeland, Donald R, **The science and engineering of materials**, Cengage Learning,

Shackelford, James F, **Introduction to materials science for engineers**, Prentice-Hall,

Complementary Bibliography

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Recommendations

Subjects that continue the syllabus

Materials engineering/V12G380V01504

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

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

Other comments

To enroll in this course it is necessary to have completed or been enrolled in all the courses in previous terms of the degree
In the event of inconsistency or discrepancy between the Spanish version and any of the other linguistic versions of this publication, the Spanish language version shall prevail

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained
All the lecture-based sessions will be maintained, moving them totally or partially to an online version, through the Online Campus (Campus Remoto) of the UVigo.

* Teaching methodologies modified
Laboratory sessions will be modified to adapt the group size to that set by the University or the EEI as safe. Sessions will be organized to ensure the safety distance. All the activities that can be performed in non face-to-face mode will be deployed on online platforms.

* Non-face-to-face student attention (tutoring)
Non-face-to-face tutorial services will be held through the virtual offices on the Online Campus, although the attention of the students may be carried out also by other ways (email, videoconference, FAITIC forums, ...), always after previous agreement with the teacher.

* Modifications (if applicable) of the contents of the course
According to the moment when the University decision of starting non-face-to face or mix teaching is made, some reduction of the lab contents will need to be done, following the defined organization. Students will be informed of the changes through FAITIC platform.

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

* Other modifications

=== ADAPTATION OF THE COURSE ASSESSMENT ===

* Tests already carried out
The marks obtained in the continuous assessment tests already performed will maintain their weight in the final grade without changes, as defined in the teaching guide.

* Pending tests that are maintained
- Those continuous assessment tests or exams that have not yet been done will also maintain their contribution in the final grade, as defined in the teaching guide. Exams will be held face-to-face if possible and will be adapted to take place fully online, if the applied contingency measures make it necessary.

* Tests that are modified
- Final exam: The final exam weight (70% of the course grade) can be modified depending on the date when the non face-to-face teaching is stablished. It can be reduced to a minimum contribution of 40% of the course grade.
- Students will be informed through Faitic of the change in the reweighting of the final exam, as well as the new tests that will be proposed to increase the weight of the continuous assessment.
- The final exam will be held face-to-face if possible but, if not, it will be adapted to be performed online.

* New tests
- In case of reducing the weight of the final exam mark in the course grade, new online tests and/or exercises will be proposed covering different items of the course syllabus and performed online using FAITIC platform. The sum of the marks for the new tests and the final exam will contribute 70% to the course grade.
- Students will receive sufficient information in advance of the new tests and the grading procedure through FAITIC platform.

* Additional Information

IDENTIFYING DATA				
Basics of circuit analysis and electrical machines				
Subject	Basics of circuit analysis and electrical machines			
Code	V12G363V01302			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	English			
Department				
Coordinator	González Estévez, Emilio José Antonio			
Lecturers	González Estévez, Emilio José Antonio Vilachá Pérez, Carlos Villanueva Torres, Daniel			
E-mail	emilio@uvigo.es			
Web	http://FAITIC			
General description	--			

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

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

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

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	18	9	27
Problem solving	10	10	20

Autonomous problem solving	0	23	23
Lecturing	22	44	66
Essay questions exam	4	0	4
Report of practices, practicum and external practices	0	10	10

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

Methodologies

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

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

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

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

Ethical commitment:

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

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

Responsible professor: DANIEL VILLANUEVA TORRES

Sources of information

Basic Bibliography

A. Bruce Carson, **Teoría de Circuitos**, Thomson Editores, S.A., 2001

A. Pastor, J. Ortega, V. Parra y A. Pérez, **Circuitos Eléctricos**, Universidad Nacional de Educación a Distancia., 2003
Suarez Creo, J. y Miranda Blanco, B.N., **Máquinas Eléctricas. Funcionamiento en régimen permanente**, 4ª, Editorial Tórculo., 2006
Jesus Fraile Mora, **Circuitos eléctricos**, Pearson, 2012
E. González, C. Garrido y J. Cidrás, **Ejercicios resueltos de circuitos eléctricos.**, Editorial Tórculo, 1999

Complementary Bibliography

Recommendations

Other comments

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

Contingency plan

Description

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

* Additional information
Keep the criteria of evaluation suitable to the realization of the proofs, in the case to be necessary and by indication in a Resolución Reitoral, to the telematic means places at the disposal of the teaching staff.

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

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

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE13	CE13 Knowledge of the principles of the theory of machines and mechanisms.
CT2	CT2 Problems resolution.
CT6	CT6 Application of computer science in the field of study.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT16	CT16 Critical thinking.

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

Contents
Topic

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

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	19.5	42.5
Problem solving	9.5	30	39.5
Laboratory practical	18	47	65
Essay questions exam	3	0	3

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

Methodologies

	Description
Lecturing	Clase magistral en la que exponen los contenidos teóricos.
Problem solving	Resolución de problemas utilizando los conceptos teóricos presentados en aula.
Laboratory practical	Realización de tareas prácticas en laboratorio docente o aula informática

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess		
Laboratory practical	Attendance and participation as well as practices reports, papers, and tests will be rated. However, to be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points. Learning outcomes: all will be graded	20	CG3 CG4	CE13	CT2 CT6 CT9 CT10 CT16

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

Other comments on the Evaluation

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

- Laboratory Practical.
  - Students are required to attend and utilized the laboratory/Computer room. Practices reports, papers, and tests for each practice session as well as proposed works/papers from tutorials will be evaluated and graded with a maximum of 2 points of the final grade. This grade will be kept for the second term in the student's evaluation records (July). To be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.
  - For those students who have been officially granted the right to waive their continued evaluation, there will be a mandatory final test where they will be able to get a maximum grade of 2 points. However, an advanced request must be made to the professor to prepare the necessary materials for this test.
- Essay questions exam. It will have a maximum grade of 8 points.

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

Ethical commitment: An adequate ethical behaviour of the student is expected at all times. In case an unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, and others); the student will be considered unfit to meet the necessary requirements to pass the subject. In this case, the overall qualification in the current academic year will be a Fail grade (0.0).
The use of any electronic devices during tests is completely forbidden unless is specified and authorized. The fact of introducing unauthorized electronic devices in the examination room will be considered reason enough to fail the subject in the current academic year and the overall qualification will be a Fail grade (0.0).
Tests Schedule: This information can be found along with any updates at the center (university) webpage.

Sources of information

Basic Bibliography

Munir Khamashta, **Problemas resueltos de cinemática de mecanismos planos**, UPC,
Munir Khamashta, **Problemas resueltos de dinámica de mecanismos planos**, UPC,
Calero Pérez, R. y Carta González, J.A., **Fundamentos de mecanismos y máquinas para ingenieros**, McGraw-Hill,

Complementary Bibliography

García Prada, J.C. Castejón, C., Rubio, H., **Problemas resueltos de Teoría de Máquinas y mecanismos**, THOMSON,
Cardona, S. y Clos D., **Teoría de Máquinas.**, UPC,
Shigley, J.E.; Uicker J.J. Jr., **Theory of Machines and Mechanisms**, McGraw-Hill,
Hernández A, **Cinemática de mecanismos: Análisis y diseño**, SÍNTESIS,
Lamadrid Martínez, A.; Corral Sáiz, A., **Cinemática y Dinámica de Máquinas**, E.T.S.I.I.T,
Mabie, Reinholtz, **Mechanisms and dynamics of machinery**, Limusa-wyley,
Nieto, j., **Síntesis de Mecanismos**, AC,
Erdman, A.G.; Sandor, G.N.,, **Mechanism Design: Analysis and Synthesis**, PRENTICE HALL,
Simon A.; Bataller A; Guerra .J.; Ortiz, A.; Cabrera, J.A., **Fundamentos de teoría de Máquinas**, BELLISCO,
Kozhevnikov SN, **Mecanismos**, Gustavo Gili,

Recommendations

Subjects that continue the syllabus

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

Subjects that it is recommended to have taken before

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

Other comments

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

Contingency plan

Description

In the event that attendance to classes become legally entirely or partially limited, the measures set on place will be:
1. To guarantee the necessary means, namely personal computer or internet access, to every enrolled student so they can follow the distance learning classes, appropriately. Therefore, to apply the appropriate solutions, any student who does not have any of these means should inform the course coordinator.
2. To inform students of the different measures adopted, the department will use the platform, Faitic.
3. On top of that, in the case of cancelation of face-to-face classes, the teaching guide will show the next modifications:
A. Competences. They will not be modified.
B. Learning outcomes. They will not be modified.
C. Contents. They will not be modified.
D. Planning. It will not be modified.
E. Methodology. It will be modified:
Lecturing and Problem solving. They will require the employment of electronic means (virtual classroom of the Remote Campus or others).
Laboratory Practices. The department will provide every student access to dynamic simulation software, so that they can carry out the practices remotely instead of from the Mechanical Engineering laboratory. The professor will supervise these practices using electronic means (virtual classroom of the Remote Campus or others).
F. Tutoring Lessons. They will be carried out by previously arranged electronic means (e-mail, faitic forums, virtual classroom at campus remote, □).
G. Assessment. Assessment methodologies/test will not be modified: Laboratory practical and Essay questions exam. Description, weight, and competences they will not be modified. All exams will use electronic means (virtual classroom of the Remote Campus or others); the department will publish in advance the specific rules for each test in the platform, Faitic. According to attendance at the virtual practice sessions, the professor will compute and validate each practice attendance on virtual classroom of the Remote Campus.
Partial tests for the evaluation of specific contests of the subject can be proposed. Once again, the professor will publish in advance the rules concerning each test in the platform, Faitic.
H. Bibliography. Besides the bibliographical references found in this guide, the documentation provided at Faitic, and the problem bulletins and previous exams, the professor might facilitate additional notes, videos, web-references, and others, so that students can appropriately follow the course during the non-face-to-face classes.
This guide can be modified following Rectoral rules.

IDENTIFYING DATA				
Automation and control fundamentals				
Subject	Automation and control fundamentals			
Code	V12G363V01304			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Rodríguez Diéguez, Amador			
Lecturers	Rodríguez Diéguez, Amador			
E-mail	amador@uvigo.es			
Web	http://faitic.uvigo.es			
General description	In this matter present the basic concepts of the systems of industrial automation and of the methods of control, considering like central elements of the same the programmable programmable logic controller and the industrial controller, respectively.			

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

Contents	
Topic	
1. Introducción to industrial automation and elements of automation.	1.1 Introducción to automation of tasks. 1.2 Types of control. 1.3 The programmable logic controller. 1.4 Diagrama of blocks. Elements of the PLC. 1.5 Cycle of operation of the PLC. Time of cycle. 1.6 Ways of operation.
2. Languages and programming technics of programmable logic controllers.	2.1 Binary, octal, hexadecimal, BCD systems. Real numbers. 2.2 Access and adressing to periphery. 2.3 Instructions, variables and operating. 2.4 Forms of representation of a program. 2.5 Types of modules of program. 2.6 linear Programming and estructurada. 2.7 Variables binarias. Entrances, exits and memory. 2.8 Binary combinations. 2.9 Operations of allocation. 2.10 Timers and counters. 2.11 Operations aritméticas.
3. Tools for sequential systems modelling.	3.1 Basic principles. Modelling technics. 3.2 Modelling by means of Petri Networks. 3.2.1 Definition of stages and transitions. Rules of evolution. 3.2.2 Conditional election between several alternatives. 3.2.3 Simultaneous sequences. Concurrence. Resource shared. 3.3 Implementation of Petri Networks. 3.3.1 Direct implementation. 3.3.2 Normalised implementation (Grafcet). 3.4 Examples.
4. Control systems introduction.	4.1 Systems of regulation in open loop and closed loop. 4.2 Control typical loop. Nomenclature and definitions.

5. Representation, modelling and simulation of continuous dynamic systems.	5.1 Physical systems and mathematical models. 5.2.1 Mechanical systems. 5.2.2 Electrical systems. 5.2.3 Others. 5.3 Modelling in state space. 5.4 Modelling in transfer function. Laplace transform. Properties. Examples. 5.5 Blocks diagrams.
6. Analysis of continous dynamical systems.	6.1 Stability. 6.2 Transient response. 6.2.1 First order systems. Differential equation and transfer function. Examples. 6.2.2 Second order systems. Differential equation and transfer function. Examples. 6.2.3 Effect of the addition of poles and zeros. 6.3 Systems reduction. 6.4 Steady-state response. 6.4.1 Steady-state errors. 6.4.2 Input signals and system type. 6.4.3 Error constants.
7. PID controller. Parameters tunning of industrial controllers.	7.1 Basic control actions. Proportional effects, integral and derivative. 7.2 PID controller. 7.3 Empirical methods of tuning of industrial controllers. 7.3.1 Open loop tuning: Ziegler-Nichols and others. 7.3.2 Closed loop tuning: Ziegler-Nichols and others. 7.4 Controllers design state space. Pole assigment.
P1. Introduction to STEP7.	Introduction to the program STEP7, that allows to create and modify programs for the Siemens PLC S7-300 and S7-400.
P2. Programming in STEP7.	Modelling of simple automation system and implementation in STEP7 using binary operations.
P3. Implementation of PN in STEP7.	Petri Networks modelling of simple automation system and introduction to the implementation of the same in STEP7.
P4. PN Modelling and implementation in STEP7.	Petri Networks modelling of complex automation system and implementation of the same in STEP7.
P5. GRAFCET modelling and implementation with S7-Graph.	Petri Networks normalised modelling and implementation with S7-Graph.
P6. Control systems analysis with MATLAB.	Introduction to the control systems instructions of the program MATLAB.
P7. Introduction to SIMULINK.	Introduction to SIMULINK program, an extension of MATLAB for dynamic systems simulation.
P8. Modelling and transient response in SIMULINK.	Modelling and simulation of control systems with SIMULINK.
P9. Empirical tuning of an industrial controller.	Parameters tuning of a PID controller by the methods studied and implementation of the control calculated in an industrial controller.

Planning

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

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

Methodologies

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

Personalized assistance

Methodologies	Description

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

Assessment

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

Other comments on the Evaluation

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

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

ROMERA J.P., LORITE J.A., MONTORO S., **Automatización : problemas resueltos con autómatas programables**, 4ª, Paraninfo, 2002
BARRIENTOS, ANTONIO, **Control de sistemas continuos: Problemas resueltos**, 1ª, McGraw-Hill, 1997
OGATA, KATSUIKO, **Ingeniería de Control Moderna**, 5ª, Pearson, 2010

Recommendations

Subjects that continue the syllabus

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

Subjects that are recommended to be taken simultaneously

Electronic technology/V12G380V01404

Subjects that it is recommended to have taken before

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

Other comments

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

Contingency plan

Description

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

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching Methodologies that keep

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

* Teaching methodologies that modify

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

* Adaptation of tutorial sessions and personalized attention

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

=== ADAPTATION OF THE EVALUATION ===

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

IDENTIFYING DATA				
Fundamentos de organización de empresas				
Subject	Fundamentos de organización de empresas			
Code	V12G363V01305			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	1c
Teaching language	Castelán			
Department	Organización de empresas e márketing			
Coordinator	Mejías Sacaluga, Ana María			
Lecturers	Doiro Sancho, Manuel Mejías Sacaluga, Ana María			
E-mail	mejias@uvigo.es			
Web				
General description				

Competencias	
Code	
CG8	CG8 Capacidade para aplicar os principios e métodos da calidade.
CG9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
CE15	CE15 Coñecementos básicos dos sistemas de produción e fabricación.
CE17	CE17 Coñecementos aplicados de organización de empresas.
CT1	CT1 Análise e síntese.
CT2	CT2 Resolución de problemas.
CT7	CT7 Capacidade de organizar e planificar.
CT8	CT8 Toma de decisións.
CT9	CT9 Aplicar coñecementos.
CT11	CT11 Planificar cambios que melloren sistemas globais.
CT18	CT18 Traballo nun contexto internacional.

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

Contidos	
Topic	
PARTE *I. CONTORNA ACTUAL E SISTEMAS PRODUTIVOS	1.CONTORNA ACTUAL DA EMPRESA.Os SISTEMAS PRODUTIVOS
PARTE *II. PREVISIÓN DA DEMANDA	2. INTRODUCIÓN. COMPOÑENTES. MÉTODOS DE PREVISIÓN DA DEMANDA: CUANTITATIVOS E CUALITATIVOS
PARTE *III. XESTIÓN DE INVENTARIOS E XESTIÓN DE PRODUCIÓN	3.CONCEPTOS BÁSICOS DE CONTROL E XESTIÓN DE INVENTARIOS.CONTROL DE INVENTARIOS 4.XESTIÓN DE INVENTARIOS MODELOS BÁSICOS
PARTE *IV. XESTIÓN DE PRODUCIÓN EN EMPRESAS INDUSTRIAIS	5.PLANIFICACIÓN DE PRODUCIÓN. PLAN AGREGADO. PLAN MESTRE DE PRODUCIÓN 6.PLANIFICACIÓN DE NECESIDADES DE MATERIAIS (*MRP) 7.PLANIFICACIÓN DE CAPACIDADE. PROGRAMACIÓN DE PRODUCIÓN. CRITERIOS E REGRAS BÁSICAS
PARTE *V. INTRODUCIÓN Ao ESTUDO DO TRABALLO	8.INTRODUCIÓN Ao ESTUDO DO TRABALLO. DISTRIBUCIÓN EN PLANTA
PARTE VIN. XESTIÓN LEAN	9.O ENFOQUE LEAN NA XESTIÓN. DEFINICIÓN E OBXECTIVOS. ELEMENTOS LEAN

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

Planificación

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

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

Metodoloxía docente

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

Atención personalizada

Methodologies	Description
Lección maxistral	
Prácticas con apoio das TIC	

Avaliación

	Description	Qualification	Evaluated Competencess		
Exame de preguntas obxectivas	2 Teórico-Prácticas: Probas de avaliación continua que se realizarán ao longo do curso, nas clases de teoría, distribuídas de forma uniforme e programadas para que non interfiran no resto das materias.	60	CG8 CG9	CE15 CE17	CT1 CT2 CT7 CT8 CT9 CT11 CT18
Práctica de laboratorio	1 Exercicios: Proba de avaliación continua que se realizará nas clases de prácticas.	40	CG8 CG9	CE15 CE17	CT1 CT2 CT7 CT8 CT9 CT11 CT18

Other comments on the Evaluation

En todos os casos, en cada proba (teórico-práctica ou de exercicios) debe alcanzarse un mínimo de 4 puntos para que se poida compensar co resto de notas. Soamente poderase compensar unha proba cando o resto das notas estean por encima do valor mínimo (4). Aclaración A modo de exemplo, un alumno que teña as seguintes puntuacións: 4, 4 e 7 compensaría as partes coa nota de 4 e superaría a materia. No caso de que as notas obtidas fosen 3, 4 e 8 NON compensa a materia e tampouco compensa a proba coa nota de 4 (xa que o resto das notas non cumpren a condición do valor mínimo de 4 puntos). Neste último caso o alumno tería que ir a Xaneiro/Xuño coa proba reducida ou ampliada, segundo o caso. Sinalar que á hora de facer a media entre as diferentes partes debe terse en conta a ponderación das mesmas. AVALIACIÓN CONTINUA (cualificación sobre 10) Para superar a materia por Avaliación Continua deben cumprirse os seguintes puntos: É imprescindible realizar con aproveitamento as prácticas da materia asistindo ás mesmas e entregando a resolución dos

exercicios propostos. Só se permitirán 2 faltas ao longo de todo o curso, debéndose entregar a resolución das mesmas. O comportamento inadecuado nas clases penalizarase coma se fose unha falta. Unha vez superado o tope das 2 faltas non se poderá aprobar a materia por avaliación continua. Débense superar (e/ou compensar) todas as probas (teórico-prácticas e de exercicios). Os alumnos que superen a Avaliación Continua quedarán exentos das convocatorias oficiais. No entanto, poderán presentarse no caso de que queiran optar a maior nota. No caso de superar a Avaliación Continua e presentarse ás convocatorias oficiais, a nota final será a que se obteña como resultado de ambas as probas. CONVOCATORIAS OFICIAIS (cualificación sobre 10) Os alumnos que NON superasen a avaliación continua e teñan soamente unha parte pendente poderán recuperar esta unicamente na convocatoria de Xaneiro/Xuño. No resto dos casos: Aqueles alumnos que desenvolvesen con aproveitamento as prácticas (é dicir, que asistan e entreguen a resolución das mesmas), realizarán unha proba reducida cun parte teórico-práctica (60% da nota) e outra de exercicios (40% da nota). Aqueles alumnos que non cumpran a condición das prácticas, realizarán unha proba ampliada cunha parte teórico-práctica (60% da nota) e outra de exercicios (40% da nota). Cualificación final. A nota final do alumno calcularase a partir das notas das distintas probas tendo en conta a *ponderación destas (probas tipo test 60% e parte de prácticas 40%). En calquera caso, para superar a materia é condición necesaria superar todas a partes ou ben ter unha media de aprobado sen que ningunha das notas sexa inferior ao 4 (nota mínima para compensar). Nos casos nos que a nota media sexa igual ou superior ao valor do aprobado pero nalgunha das parte non se alcanzou o valor mínimo de 4, a cualificación final será de suspenso. A modo de exemplo, un alumno que obtivese as seguintes cualificacións: 5, 9 e 1 estaría suspenso, aínda cando a nota media dá un valor >=5, ao ter unha das partes por baixo da nota de corte (4). Nestes casos, a nota que se reflectirá na acta será de suspenso (4).

Compromiso ético: Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizado, e outros) considérase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no actual curso académico será de suspenso (0.0).
Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado na aula de exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0.0).

Bibliografía. Fontes de información

Basic Bibliography

Chase, R.B y Davis, M.M., **Administración de Operaciones. Producción y cadena de suministros**, McGraw-Hill, 2004

Domínguez Machuca, J.A., **Dirección de Operaciones: aspectos tácticos y operativos en la producción y los servicios**, McGraw-Hill, 1995

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

Complementary Bibliography

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

Larrañeta, J.C., Onieva, L. y Lozano, S., **Métodos Modernos de gestión de la Producción**, Alianza Editorial, 2015

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

Vollmann, T.E., Berry, W.L. y Whybark, D.C ., **Sistemas de Planificación y Control de la Fabricación**, Irwin, 1995

Recomendacións

Other comments

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

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

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

* Mecanismo non presencial de atención ao alumnado (titorías)
Indicaranse franxas horarias para a súa impartición a través do campus remoto e/ou baixo demanda do alumnado previo envío de correo electrónico.

* Modificacións (se proceder) dos contidos a impartir

* Bibliografía adicional para facilitar a auto-aprendizaxe

* Outras modificacións

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

* Probas xa realizadas
Proba XX: [Peso anterior 00%] [Peso Proposto 00%]
...

* Probas pendentes que se manteñen
Proba XX: [Peso anterior 00%] [Peso Proposto 00%]
...

* Probas que se modifican
[Proba anterior] => [Proba nova]

* Novas probas

* Información adicional

IDENTIFYING DATA				
Electronic technology				
Subject	Electronic technology			
Code	V12G363V01401			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	English			
Department				
Coordinator	Soto Campos, Enrique			
Lecturers	Soto Campos, Enrique			
E-mail	esotoc@uvigo.es			
Web	http://faitic.uvigo.es			
General description	The objective of this course is to provide the students with the theoretical and practical fundamental knowledge in electronics' five main areas: analog electronics, digital electronics, industrial sensors, power electronics and communications electronics. In case of any discrepancy between this translation of the guide and the Spanish version, the valid one is the Spanish version.			

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

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

Contents	
Topic	
Introduction	- Control and supervision of industrial systems by means of electronics - Some representative cases
Electronic devices, circuits and systems	- Electronics components and devices - Active and passive electronic devices - Analog and digital electronic circuits - Electronic systems
Diodes and rectification	- The diode - Operation modes and characteristics - Diodes types - Operation Models - Analysis of circuits with diodes - Rectifier circuits - Filtering for rectifier circuits - Thyristors

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	25	0	25
Problem solving	8	0	8
Previous studies	0	49	49
Autonomous problem solving	0	46	46
Laboratory practical	18	0	18
Objective questions exam	1	0	1
Essay questions exam	3	0	3
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	These sessions will be held in the rooms and dates fixed by the direction of the school. They will consist in an oral explanation by the professor of the most important parts of the course, all related with the materials that the student had to work previously. This is intended to favor the active participation of the students, that will have occasion to rise doubts and questions during the sessions. Active participation is desired during all the sessions.
Problem solving	During these sessions, in the classroom, interleaved with the lectures, the professor will proceed to solve examples and/or exercises that properly illustrate the problems to solve. As long as the number of participants in the classroom allows, active participation will be promoted.
Previous studies	Previous preparation of the theoretical sessions: Prior to the start of the theoretical sessions, the students will have available a series of materials that have to prepare, as the sessions will relay on them. Previous preparation of the laboratory sessions: It is mandatory that the students make all the assigned previous tasks prior to access the laboratory. These task are intended to greatly improve the laboratory knowledge acquisition. The achieved report will be taken into account when the laboratory session is to be evaluated.

Autonomous problem solving	Self study and review of the theoretical sessions for knowledge consolidation: The student must study, in a systematic time schedule, after each lecture session, in order to dissipate any doubts. Any doubts or unsolved questions will have to be expose to the professor as soon as possible in order to enhance the feedback of the learning process.
Laboratory practical	Laboratory sessions will be held in the time schedule established by the school's head teacher. Students will work in groups of two students each. The sessions will be supervised by a professor, who will control the assistance and will also evaluate the harnessing of it. During the laboratory sessionsthe students will make activities of the following kinds: - Assembling electronics circuits - Use of electronic instrumentation - Measure of physical variables on circuits - Do calculations related to the circuit and/or the measurements - Collect data and represent it (diagrams, charts, tables) At the end of each laboratory session each group will deliver the corresponding score sheets.

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

EVALUATION AND GRADING OF THE SUBJECT

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

Self assessment :

Associated with each topic there are severalself-assessment questionnaires. There are short questionnaires after each section or pill into which each topic is divided, and a larger and more comprehensive questionnaire at the end of each topic. These self-assessment questionnaires have no influence on the grade. The purpose of these questionnaires is to help students assess their level of knowledge about each of the topics. The answers of these questionnaires by the students provide valuable information to the teaching staff about those aspects of the subject in which the students find greater difficulties.

Laboratory sessions:

The evaluation of the laboratory sessions accounts for 20% of the course grade. The laboratory sessions are evaluated one

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

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

Theory:

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

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

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

- Incomplete option: Only examined from P2. Theresulting grade will be NT = P1 + P2
- Complete option: The student renounces the grade of P1 obtained in the first session and takes a complete exam (EC) of the entire theory. The grade will be NT = EC.

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

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

Other considerations

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

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

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

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

Recommendations:

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

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

The students must meet the deadlines for all the activities.

All the achieved results must be justified, in any of the exams or activities. None of the achieved results will be taken for good if no explanation is given about the method used to find them. The selected method for solving a problem is considered when grading the solution.

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

Exams lacking some of the sheets will not be graded.

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

Competencies Acquisition and Its Influence on Assesments

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

Sources of information

Basic Bibliography

Malvino, Albert; Bates, David J., **Principios de Electrónica**, 7ª,
Boylestad, R. L.; Nashelsky, L., **ELECTRÓNICA: TEORIA DE CIRCUITOS Y DISPOSITIVOS ELECTRONICOS**, 10ª,
Rashid, M.H., **CIRCUITOS MICROELECTRONICOS: ANALISIS Y DISEÑO**, 2ª,
TOCCI, RONALD J., NEAL S. WIDMER , GREGORY L. MOSS, **Sistemas digitales. Principios y aplicaciones**, 10ª,
Lago Ferreiro, A.; Nogueiras Meléndez, A. A., **Dispositivos y Circuitos Electrónicos Analógicos: Aplicación práctica en laboratorio**,

Complementary Bibliography

Malik N. R., **Electronic Circuits. Analysis, simulation, and design**,
Wait, J.; Huelsman, L.; Korn, G., **INTRODUCCION AL AMPLIFICADOR OPERACIONAL**, 4ª,
Pleite Guerra, J.; Vergaz Benito, R.; Ruíz de Marcos; J. M., **Electrónica analógica para ingenieros.**,

Recommendations

Subjects that are recommended to be taken simultaneously

Fundamentals of automation/V12G380V01403

Subjects that it is recommended to have taken before

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

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

Theory sessions:

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

Laboratory sessions:

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

Tutorials:

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

Evaluation:

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

IDENTIFYING DATA				
Fundamentals of manufacturing systems and technologies				
Subject	Fundamentals of manufacturing systems and technologies			
Code	V12G363V01402			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Diéguez Quintas, José Luís			
Lecturers	Diéguez Quintas, José Luís Fenollera Bolíbar, María Inmaculada Hernández Martín, Primo Queimaño Piñeiro, David			
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General description	The educational aims of Foundations of Systems and Technologies of Manufacture, in his fundamental and descriptive appearances, centre in the study and the application of scientific knowledges and technicians related with the processes of manufacture of components and conjoint whose functional purpose is mechanical, as well as the evaluation of his dimensional precision and the one of the products to obtain, with a determinate quality. All this including from the phases of preparation until the ones of utilisation of the instruments, the tools, toolings, teams, machines tool and necessary systems for his realisation, in accordance with the norms and specifications established, and applying criteria of optimisation. To reach the aims mentioned will give the following thematic educational: - Foundations of dimensional metrology. Measure of length, angles, forms and elements of machines. - Study, analysis and evaluation of the dimensional tolerances. Chain of tolerances. Optimisation of the tolerances. Systems of adjust and tolerances. - Processes of conformed of materials by means of start of material, operations, scheme, teams and tooling - Processes of conformed by means of plastic deformation, operations, scheme, teams and tooling - Processes of conformed by *moldeo, operations, scheme, teams and tooling - Processes of conformed no conventional, operations, scheme, teams and tooling. - Conformed of polymers, and other no metallic materials, operations, scheme, teams and tooling - Processes of union and assembling, operations, scheme, teams and tooling - Foundations of the programming of scheme with *CNC, used in the mechanical manufacture.			

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

Contents	
Topic	
DIDACTIC UNIT 1. INTRODUCTION To THE TECHNOLOGIES And SYSTEMS OF MANUFACTURE.	Lesson 1. INTRODUCTION To THE ENGINEERING OF *FABRICACION. The productive cycle. Classification of industries. Technologies of manufacture.

DIDACTIC UNIT 2. *METROTECNIA.	Lesson 2. PRINCIPLES OF DIMENSIONAL METROLOGY. Introduction. Definitions and concepts. The International System of Units. Physical magnitudes that covers the Dimensional Metrology. Elements that take part in the measurement. Classifications of the methods of measure. Patterns. The chain of *trazabilidad. *Calibración. Uncertainty. Chain of *calibración and transmission of the uncertainty. Relation between tolerance and uncertainty. Expression of the uncertainty of measure in *calibración. Lesson 3. INSTRUMENTS And METHODS OF MEASURE. Introduction. Patterns. Instruments of verification. Patterns *interferométricos. Principles of *interferometría. Instruments of direct measure. Methods and instruments of indirect measure. Lesson 4. MEASUREMENT BY COORDINATES. MEASUREMENT BY IMAGE. SUPERFICIAL QUALITY. Machines of measurement by coordinates. Concept. Principles of the MMC. Classification of the machines. Main components of the MMC. Process to be followed for the development of a measure. Systems of measurement by image. Superficial quality. Methods of measure of the *rugosidad. Parameters of *rugosidad.
DIDACTIC UNIT 3. PROCESSES OF CONFORMED BY START OF MATERIAL	Lesson 5. INTRODUCTION To THE CONFORMED BY START OF MATERIAL. Introduction. Movements in the process of start of material. Factors to take into account in the election of the tool. Geometry of tool. Materials of tool. Mechanism of training of the shaving. Types of shavings. Power and strengths of court. Wear of tool. Criteria of wear of tool. Determination of the life of the tool. Flowed of court. Lesson 6. TURNING: OPERATIONS, SCHEME And TOOLING. Introduction. Main operations in lathe. The machine-tool: the lathe. Main parts of the lathe. Setting or subjection of pieces. Typical tools of the lathe. Special lathes. Lesson 7. MILLED: OPERATIONS, MACHINES And TOOLING. Introduction. Description and classification of the operations of milled. Parts and main types of *fresadoras. Types of strawberries. Setting of the tool. Subjection of pieces. Different configurations of *fresadoras. *Fresadoras Special. Lesson 8. MECHANISED OF HOLES And WITH RECTILINEAR MAIN MOVEMENT: OPERATIONS, MACHINES And TOOLING. Introduction to the operations of mechanised of holes. Punches. *Mandrinadoras. General characteristics of the processes of mechanised with rectilinear main movement. *Limadora. *Mortajadora. *Cepilladora. *Brochadora. Saws. Lesson 9. CONFORMED WITH ABRASIVE: OPERATIONS, MACHINES And TOOLING. Introduction to the operations of mechanised of holes. You grind abrasive. Operation of rectified. Types of *rectificadoras. *Honeado. *Lapeado. Polishing. Burnished. *Superacabado Lesson 10. PROCESSES OF MECHANISED NO CONVENTIONAL. Introduction. The mechanised by electroerosion or *electro-download. Mechanised electrochemical. Mechanised by laser. Mechanised by *chorro of water. Court by arch of plasma. Mechanised by ultrasounds. Milled chemist.
DIDACTIC UNIT 4. AUTOMATION And MANAGEMENT OF THE PROCESSES OF MANUFACTURE.	Lesson 11. NUMERICAL CONTROL OF MACHINES TOOL. Introduction. Advantages of the application of the *CN in the machines tool. Necessary information for the creation of a program of *CN. Manual programming of *MHCN. Types of language of *CN. Structure of a program in code ISO. Characters employed. Preparatory functions (G__). Auxiliary functions (M__). Interpretation of the main functions. Examples. Automatic programming in numerical control.

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

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

Planning

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

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

Methodologies

	Description
Lecturing	Las clases teóricas se realizarán combinando las explicaciones de pizarra con el empleo de vídeos y presentaciones de ordenador. La finalidad de estas es complementar el contenido de los apuntes, interpretando los conceptos en estos expuestos mediante la muestra de ejemplos y la realización de ejercicios.
Laboratory practical	Las clases prácticas de laboratorio se realizarán en 9 sesiones de 2 horas, salvo los alumnos del curso puente que realizarán las prácticas en las 6 sesiones que contempla su horario particular, en grupos de 20 alumnos máximo, y empleando los recursos disponibles de instrumentos y máquinas, combinándose con las simulaciones por ordenador.

Personalized assistance

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

Assessment

Description	Qualification	Evaluated Competencess

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

Other comments on the Evaluation

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

Sources of information

Basic Bibliography

Complementary Bibliography

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

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

Recommendations

Subjects that continue the syllabus

Manufacturing engineering and dimensional quality/V12G380V01604

Subjects that are recommended to be taken simultaneously

Materials science and technology/V12G350V01305

Other comments

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

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

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

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

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

Contents
Topic

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

7. Open-Channel Flow	7.1 Introduction 7.2 Uniform Flow 7.2.1 Pipes used like channels 7.3 Non uniform flow 7.3.1 The hydarulic jump 7.3.2 Fast transitions 7.3.3 Flow over a gate 7.3.4 Flow under a gate 7.3.5 Section of control
8. Experimentation withFflows. Discharge Measurement. Pressure Measurement. Speed Measurement	8.1 Pressure Gauge 8.1.1 Simple pressure gauge 8.1.2 Bourdon pressure gauge 8.1.3 Transductor of pressure 8.2 Speed measurement 8.2.1 Pitot tube 8.2.2 Prandtl tube 8.2.3 Rotative anemometer 8.2.4 Hot thread anemometer 8.2.5 Laser-doppler anemometer 8.3 Flow measurement 8.3.1 Differential pressure: diaphragm, venturi, nozzle 8.3.2 Other types

Planning

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

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

Methodologies

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

Personalized assistance

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

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

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

Other comments on the Evaluation

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

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

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

The student is expected to exhibit adequate ethical behaviour. In case of noticing a non-ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices, and others) it will be considered that the student does not gather the necessary requirements to pass the course. In this case, the global qualification of the present academic course will be failed (0.0). The use of any electronic device during the evaluation tests will not be allowed unless expressly authorized. The fact of introducing an electronic device not authorized in the exam room will be considered a reason for not passing the subject in this present academic course and the global qualification will be failed (0.0).

Sources of information

Basic Bibliography

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

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

Antonio Crespo, **Mecánica de fluidos**,

Complementary Bibliography

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

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

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

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

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

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

Recommendations

Subjects that are recommended to be taken simultaneously

Thermodynamics and heat transfer/V12G380V01302

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Mathematics: Algebra and statistics/V12G380V01103

Mathematics: Calculus I/V12G380V01104
Mathematics: Calculus II and differential equations/V12G380V01204

Other comments

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

Contingency plan

Description

EXCEPTIONAL PLANNING
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishesan extraordinary planning that will be activated when the administrations and the institution itself determine it, consideringsafety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee,at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well inadvance) by the students and teachers through the standardized tool.

ADAPTATION OF THE METHODOLOGIES
Teaching methodologies maintained: Lecture and tutoring. In any case, if it is needed, they will be substituted by distance learning, using CAMPUS REMOTO or any other available platform

Teaching methodologies modified: Laboratory. This will be substituted by explanatory videos or additional teaching material to explain the different topics

Non-attendance mechanisms for student attention (tutoring): Telematic technology will be used, such as CAMPUS REMOTO or any other available platform, to get in contact with the students

Modifications (if applicable) of the contents: None

Additional bibliography to facilitate self-learning: None

Other modifications: Assessment criteria does not change.

ADAPTATION OF THE TESTS
If it is needed, Final exam will be substituted by 2 or 3 continuous evaluation tests. These tests can comprise test questions (true or false or several choices) or exercises to solve through Faitic or Campus Remoto in a limited period of time

IDENTIFYING DATA				
Mechanics of materials				
Subject	Mechanics of materials			
Code	V12G363V01404			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Caamaño Martínez, José Carlos Riveiro Rodríguez, Belén			
Lecturers	Caamaño Martínez, José Carlos Riveiro Rodríguez, Antonio Riveiro Rodríguez, Belén Sánchez Rodríguez, Ana			
E-mail	jccaam@uvigo.es belenriveiro@uvigo.es			
Web	http://faitic.uvigo.es			
General description	Introduction to linear elastic materials, and analysis of internal loadings, stress and strain relationships. Study of the fundamentals of mechanics of materials and particularization for shafts and beam structures.			

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

Contents	
Topic	
1. Introduction	1.1 Introduction 1.2 Review of statics fundamentals and applied concepts for further progress in solid mechanics and stress analysis
2. Basic principles of elasticity and mechanics of materials.	2.0 Stress and strain. Linear elastic materials 2.1. Normal stress in an axially loaded prismatic bar. 2.2. Equilibrium of a deformable body. 2.3. Stress-Strain diagram of ductile materials. Hooke’s Law. 2.4. Stress resultants. Diagrams.
3. Axial loads	3.1. Normal forces. 3.2. Elastic deformation of an axially loaded member. 3.3. Statically governed problems. 3.4. Statically indeterminate problems. 3.5. Thermal stress and assembly misfits.
4. Bending and shear	4.1 Beams: definition and types. Loads on beams. 4.2 Internal shear forces and bending moments. 4.3 External load, shear force and bending moment relationships. 4.4 Shear and moment diagrams 4.5 Pure bending and non-uniform bending. Hypothesis and limitations. 4.6. Normal stresses in unsymmetric bending. 4.7 Symmetric bending. The flexure formula (Navier’s Law). 4.8 Section modulus of a beam. Ideal beam cross-section. 4.9 Deflection of beams and shafts. Slope and deflection. 4.10 Hyperstatic bending. 4.11 The shear formula.
5. Introduction to compressive buckling	4.1. Definition 4.2. Critical load. Euler's formula. 4.3. Limitations of Euler's formula. 4.4. Practical applications.
6. Introduction to torsion	6.1. Definition. 6.2. Torsion in circula shafts. 6.3. Torque diagrams.. 6.4. Torsional stresses and deformations.

Planning

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

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

Methodologies

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

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess
Laboratory practical	A) it will evaluate the attendance and active participation in all the practicals of the semester, as well as the correct delivery (time and form) of all the documentation requested (reports, exercises, etc.). Practical sessions will be held in a fixed date, so it is not possible to attend the practical in a later date. Whether the student does not attend to a practical, he/she must demonstrate that the absence was due to unavoidable reasons (e.g. medical reasons). Practicals will marked with the value indicated, only when the student reaches the minimum mark in the written exam, which is 45%. (See following section: 'Other comments')	2.5	
Project based learning	C) Written tests to evaluate the individual work delivered by the student. It will be compulsory the attendance to the 90% of the practicals to obtain the marks given in section C. The marks obtained in the sections A will proportionally affect to the marks of the section C. The section C will be marked with a maximum value of 12,5% of the total mark, only when the student reach the minimum mark in the written exam, which is 45%. (See following section: 'Other comments')	12.5	
Essay questions exam	Written exam in the dates established by the School.	85	

Other comments on the Evaluation

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

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

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

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

Sources of information

Basic Bibliography

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

Manuel Vázquez, **Resistencia de materiales**,

Complementary Bibliography

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

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

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

Recommendations

Other comments

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE ASSESSMENT ===
* Teaching methodologies that do not change
All the methodologies keep being the same as they can be held using the Campus Remoto platform complemented with faitic:
- Lecturing
- Project based learning
- Laboratory practical (only if mix teaching is adopted)

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

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

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

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

* Other

=== ADAPTACIÓN DE LA EVALUACIÓN ===
* Tests that are modified
[Laboratory practical] => [Systematic observation] [5%]
(this correspond to mark "A", in the formula for continuos assessment)

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

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

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

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

* Additional information

IDENTIFYING DATA				
Termodinámica e trasmisión de calor				
Subject	Termodinámica e trasmisión de calor			
Code	V12G363V01405			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2	2c
Teaching language	Castelán			
Department	Enxeñaría mecánica, máquinas e motores térmicos e fluídos			
Coordinator	Santos Navarro, José Manuel Giraldez Leirado, Alejandro			
Lecturers	Baqueiro Vidal, María Giraldez Leirado, Alejandro Morán González, Jorge Carlos Pazo Prieto, José Antonio Pequeño Aboy, Horacio Rodríguez Fernández-Arroyo, Juan Ignacio Santos Navarro, José Manuel Vidal López, Antonio José			
E-mail	agiraldez@uvigo.es josanna@uvigo.es			
Web				
General description	Na práctica totalidade dos procesos industriais requírese a aplicación dos Principios da Termodinámica e da Transferencia de Calor. O coñecemento destes principios é básico en Enxeñaría Térmica. Por exemplo, para a realización dunha análise enerxética (con determinación do rendemento enerxético e *exergético) de sistemas de potencia para a xeración de electricidade (ciclo combinado con *turbina de vapor e de gas), un ciclo de potencia mecánica, un ciclo en bomba de calor, etc. O coñecemento de se un proceso termodinámico pode ocorrer ou non na realidade é imprescindible para o deseño de novos procesos, así como o coñecemento das máximas prestacións que se poden obter nos diferentes dispositivos que compoñen unha instalación enerxética, e cales son as causas que imposibilitan obter esas máximas prestacións. Ademais, o estudo das propiedades termodinámicas dos fluídos de traballo que circulan polos dispositivos, auga, aire, *refrigerantes, gases e mestura de gases, é indispensable para analizar o comportamento dos sistemas térmicos. Así mesmo, o estudo do procedemento a seguir para a análise enerxética de instalacións enerxéticas de sistemas de refrixeración, acondicionamento de aire e en procesos de combustión é de gran interese. Doutra banda, é interesante para o alumno coñecer os mecanismos polos cales se produce a transferencia da enerxía, principalmente debido a unha diferenza de temperaturas, centrándose en determinar a maneira e a velocidade á que se produce ese intercambio de enerxía. Neste sentido preséntanse o tres modos de transferencia de calor e os modelos matemáticos que permiten calcular as velocidades de transferencia de calor. Así se pretende que os alumnos sexan capaces de expor e resolver problemas *ingenieriles de transferencia de calor mediante o uso de ecuacións *algebraicas. Tamén se pretende que os alumnos coñezan outros métodos matematicamente máis complexos de resolución de problemas de transferencia de calor e saiban onde atopalos e como usalos en caso de necesitalos.			

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

Resultados de aprendizaxe

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

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

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

Metodoloxía docente	
	Description
Lección maxistral	Exposición por parte do profesor dos contidos da materia obxecto de estudo, onde se procurará a máxima participación do alumno, a través da súa implicación directa na formulación de cuestións e/ou problemas,

Prácticas de laboratorio	Experimentación de procesos reais en laboratorio e que *complemantan os contidos da materia, completado con algunha práctica con software específico CONTIDOS PRÁCTICOS: (polo menos realizaranse 3 das prácticas propostas) 1)Aplicacións do Primeiro Principio: Determinación Experimental dos Procesos *Isotermos e *Adiabáticos 2)Avaliando Propiedades Termodinámicas de Sustancias Puras mediante o uso de software informático 3)Estudo Experimental dun Ciclo de Vapor 4)Estudo Experimental dun Ciclo de Refrixeración por *Compresión de Vapor e funcionamento como Bomba de Calor 5)Cálculo Experimental da Condutividade Térmica en Placas 6)Avaliando a Transferencia de Calor por Radiación: Lei de *Stefan-*Boltzmann
Resolución de problemas de forma autónoma	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno levará a cabo mediante a consulta da bibliografía
Resolución de problemas	Resolución de problemas e/ou exercicios relacionados coa materia que o alumno realizará en aula e/ou laboratorio. Resolveranse problemas de carácter "tipo" e/ou exemplos prácticos. Salientarase o traballo en expor métodos de resolución e non nos resultados.

Atención personalizada

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

Avaliación

	Description	Qualification	Evaluated Competencess		
Resolución de problemas e/ou exercicios	Exame final escrito consistente na resolución de problemas de resposta extensa, ou exercicios e/ou cuestións teóricas, relativos aos contidos da materia desenvolvida (sesións de teoría, prácticas de laboratorio, etc.), e en tempo/condicións establecido/*as polo profesor Este exame levará a cabo nas datas fixadas pola organización docente do centro Resultados de aprendizaxe: Capacidade para coñecer, entender e utilizar os principios e fundamentos da termodinámica aplicada e a transmisión de calor	80	CG4 CG5 CG6 CG7	CE7	CT2 CT7 CT9 CT10
Exame de preguntas obxectivas	Ao longo do cuadrimestre realizaranse varias probas de seguimento. A nota correspondente ás diferentes probas de seguimento estará baseada en probas escritas de resposta curta. Esta nota corresponderase coa denominación de Avaliación Continua	20	CG6	CE7	CT2 CT7 CT9 CT10

Other comments on the Evaluation

Modalidade de seguimiento por Avaliación Continua.

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

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

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

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

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

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

Modalidade de renuncia á Avaliación Continua.

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

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

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

Criterios de cualificación.

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

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

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

CF= máximo(N1, N2), sendo,

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

N2= EF

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

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

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

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

Compromiso ético .

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

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

Bibliografía. Fontes de información

Basic Bibliography

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

Çengel Yunus A., Boles Michael A., **Thermodynamics : an engineering approach**, 7th ed, McGraw-Hill, 2011
Çengel Y.A., y Ghajar A.J., **Transferencia de Calor y Masa. fundamentos y aplicaciones**, 4ª edición, McGraw-Hill, 2011
Çengel, Yunus A., **Heat and mass transfer: a practical approach**, 4th ed, McGraw-Hill, 2011

Complementary Bibliography

Çengel Y.A., **Introduction to Thermodynamics and Heat Transfer**, McGraw-Hill, 2008
Moran M.J. y Shapiro H.N., **Fundamentos de Termodinámica Técnica**, 2ª edición - castellano, Ed. Reverté, 2004
Merle C. Porter y Craig W. Somerton, **Termodinámica para ingenieros**, McGraw-Hill/Interamericana de España, 2004
Incropera F.P. y DeWitt D.P, **Introduction to Heat Transfer**, 2002
Wark, K. y Richards, D.E., **Termodinámica**, McGraw-Hill, 2010
Kreith J. y Bohn M.S, **Principios de Transferencia de Calor**, 2001,
Mills A.F., **Transferencia de calor**, 1995

Recomendacións

Subjects that it is recommended to have taken before

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada polo COVID-19, a Universidade de Vigo establece unha planificación extraordinaria que se activará no momento en que as administracións e a propia institución determíneno atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou parcialmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun modo máis áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes.

=== ADAPTACIÓN DAS METODOLOXÍAS ===
* Metodoloxías docentes que se manteñen
SEN CAMBIOS

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

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

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

* Bibliografía adicional para facilitar o auto-aprendizaxe

* Outras modificacións

=== ADAPTACIÓN DA AVALIACIÓN ===

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

Proba "Exame de preguntas obxectivos" -> 20%

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

"Tarefas adicionais" -> 20%

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

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	60	80
Problem solving	9	18	27

Collaborative Learning	9	9	18
Laboratory practical	9	9	18
Essay questions exam	7	0	7

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

Methodologies

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

Personalized assistance

Methodologies	Description
Laboratory practical	The doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Lecturing	he doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed
Problem solving	he doubts and questions that can arise during the classes or personal assignments of the students will be solved either in situ or during the tuition hours. The tuition personal attention should be required by e-mail. The professor will use his " Virtual Office" to solve any of these questions, if in-person tuition is not needed

Assessment

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

Other comments on the Evaluation

Continuous assessment (100%):

At the end of each Part (I & II) the student will perform a test that will be scored from 0 to 10 points. The passing mark is 5. The test will cover theoretical issues and practical exercisesIn each Part the student can reach 50% of the final mark. The passed partial tests are released from the corresponding part in the final exam.
For the students who pass all tests, the final mark will be the average of the marks of the partial tests.
Students who fail any or all partial tests, will have take a final exam whrere she/he will be graded from 0 to 10 points.
To pass the subject it is necessary to achieve a minimum grade of 3 points in each part and an avereage mark bigger than 5.
Students approved by partial tests can modify (maybe improve) their mark by presenting to the final exam.
The professors will indicate the dates and places of publication of marks and revisions

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Electrical machines/V12G363V01605

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

Basics of circuit analysis and electrical machines/V12G363V01302

Other comments

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

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

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

Contents	
Topic	
Mechanical behavior of materials Properties of materials obtained by casting, molding and injection Properties of materials obtained by plastic and viscoelastic deformation Processing of metal powders Modification of properties by heat treatments, thermochemical treatments and thermomechanical treatments Welding processes and weldability Construction materials Tool materials	Plastic deformation Sheet-metal forming processes Casting and casting defects Fractography
Laboratory contents	Mechanical properties tests Non-destructive testing Metalography Hardenablity tests

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	33	66	99
Problem solving	7	7	14
Seminars	3	3	6
Laboratory practical	10	10	20
Mentored work	0	11	11
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentations given by the lecturer of the main contents of the subject

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

Personalized assistance

Methodologies	Description
Mentored work	Personalized attention, the lecturer will guide the preparation of the project. Any difficulty/doubt will be attended. Independently on the teaching modality, this support can be provided electronically (email, videoconference, FAITIC forum ...) after being formally requested.
Seminars	Personalized attention, time devoted to help students with any difficulty or doubt. Independently on the teaching modality, this support can be provided electronically (email, videoconference, FAITIC forum ...) after being formally requested.

Assessment

	Description	Qualification	Evaluated Competencess
Lecturing	The assessment will be completed with a written exam of short questions, tests or exercises. The purpose is to assess the level of knowledge achieved along the course.	60	
Laboratory practical	The laboratory activities will be assessed through the students attendance and participation, preparation of reports or visits to local companies.	25	
Mentored work	It will be assessed by the handed reports and/or the exhibition in the classroom of the prepared project.	15	

Other comments on the Evaluation

The continuous assessment will be followed during the teaching period of the subject according to the criteria established in the previous section. In the final exam, a minimum mark of 4 out of 10 is required in the own written exam to pass the subject. The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es. In case this minimum mark was not achieved, the whole mark will be that corresponding to the continuous assessment, this means that the mark of the final exam will not be added to the whole mark.

Students have the right to renounce to the continuous assessment system. This option must be asked officially. In this situation, the final exam will include the totality of the contents of the subject, and its qualification is 100%.

In the SECOND ATTEMPT (exam in July): The qualification obtained from the continuous assessment will be kept, unless the student request to be cancelled in due course. In this situation, the totality of the contents of the subject (those given in the classroom and in the laboratory) will be included in this final exam and the student could achieved 100% of the qualification. The date of the exam will be fixed by the school and can be checked at http://eei.uvigo.es.

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

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

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

Krauss, G., **Steels: Heat Treatment and Processing Principles**, ASM International,

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

Randall, M. G., **Sintering: Theory and Practice**, John Wiley & Sons,
Beeley, P., **Foundry Tecnology**, Butterworth-Heineman, Ltd.,

Recommendations

Subjects that are recommended to be taken simultaneously

Manufacturing engineering/V12G363V01604

Subjects that it is recommended to have taken before

Materials science and technology/V12G363V01301
Fundamentals of manufacturing systems and technologies/V12G363V01402
Mechanics of materials/V12G363V01404

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Methodologies
They will be adapted to the telematic tools available for the lectures. Modifications in the provided information given through FaiTIC, email or Campus Remoto will be eventually done as well.

* Non-attendance mechanisms for student attention (tutoring)
The tutoring could be given in person (provided that the health measures are guaranteed) or telematic (e-mail, Campus Remoto or FaiTIC forums) under the modality of previous agreement. A methodological adaptation will be made to students at risk, providing them with additional specific information, if it is proven that they cannot access the contents in a conventional way.

=== ADAPTATION OF THE TESTS ===

Those tests that are already being carried out telematically will be maintained and, as far as possible, the on-site tests will be maintained, adapting them to the current health regulations. The tests will be carried out in person, unless the Rector's Resolution indicates that they should be carried out in a non-presential manner, using the several tools available to the teaching staff. Those tests that cannot be carried out by telematic means will be replaced by others (guided autonomous work, etc.)

* Modification in the continuous assessment.

Continuous assessment [Previous Weight 40%] [Proposed Weight 60%]

IDENTIFYING DATA				
Physics 3				
Subject	Physics 3			
Code	V12G363V01503			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	López Vázquez, José Carlos			
Lecturers	López Vázquez, José Carlos			
E-mail	jclopez@uvigo.es			
Web	http://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	
CG10	CG10 Ability to work in a multidisciplinary and multilingual environment.
CE2	CE2 Understanding and mastering the basics of the general laws of mechanics, thermodynamics, waves and electromagnetic fields, as well as their application for solving engineering problems.
CT10	CT10 Self learning and work.

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

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

I.2. MECHANICAL WAVES	2.1. The nature of mechanical waves 2.2. Longitudinal waves in thin rods 2.3. Longitudinal waves in springs 2.4. Transverse waves in strings 2.5. Power flow and intensity of a wave 2.6. Longitudinal waves in fluids
I.3. DESCRIPTION OF PHYSICAL QUANTITIES BY MEANS OF VECTOR ANALYSIS	3.1. Differential of arc of a curve 3.2. Scalar fields 3.3. Directional derivative 3.4. Gradient 3.5. Vector fields 3.6. Flux of a vector field 3.7. Solenoidal fields 3.8. Divergence of a vector field 3.9. Ostrogradski-Gauss' theorem or divergence theorem 3.10. Divergence of a solenoidal field 3.11. Circulation of a vector field 3.12. Rotation or curl of a vector field 3.13. Stokes' theorem 3.14. Conservative fields
II.1. GENERAL EQUATIONS OF ELECTROMAGNETISM	1.1. Definition of electric and magnetic fields 1.2. Field sources: macroscopic electric charges and currents 1.3. Relations among fields E and B and their sources: Maxwell's equations 1.4. Free charge 1.5. Polarization charge 1.6. Electric current 1.7. Polarization current 1.8. Magnetization current 1.9. Maxwell's equations 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 wave on an interface between two perfect dielectrics 4.5. Incidence of a plane wave on an interface between a perfect dielectric and a conductor
III.1 LABS: STRUCTURED ACTIVITY SESSIONS	1.1 Structured activity sessions: - Experimental data processing (approximate quantities, measurement of physical magnitudes, error estimation) - Adequate operation with basic measurement instruments (flex-meter, micrometer, multimeter (analog and digital), oscilloscope) - Laboratory experiments with mechanical or electromagnetic waves (emission and reception of ultrasonic waves, microwaves or light waves, standing waves along one direction, Michelson interferometer)

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

Planning

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

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

Methodologies

	Description
Lecturing	The main topics of the subject are introduced by the teacher using projected presentations and the blackboard, emphasizing the theoretical basis and fundamentals and stressing the critical or key points. Eventually, demonstrative experiments or audiovisual material could be employed
Problem solving	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 practical	Activities for applying the knowledge to particular situations and for developing basic and procedural skills related to the subject. These activities will be held in specific rooms with specialized equipment (hardware and computer labs)

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

1. CONTINUOUS ASSESSMENT

CONTINUOUS ASSESSMENT TESTS (40%)

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

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

FINAL EXAM (60%)

- It is held in the December-January call

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

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

GLOBAL MARK

- The global mark G1 is obtained as

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

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

2. END-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 essay questions exams on topics of Parts I and II

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

GLOBAL MARK

- In this case the global mark G1 is obtained as

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

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

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

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

b) holding mark L0 and/or mark A0 instead of answering the exam(s) 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 an essay questions exam on topics of Parts I and II

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

EXAM THAT REPLACES CONTINUOUS ASSESSMENT TESTS (40%)

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

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

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

GLOBAL MARK

- In this case the global mark G2 is obtained as

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

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

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

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

b) holding the most recent marks of each type (L0 or L1 and/or A0 or A1) instead of answering the exam(s) 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 exams 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 global mark for students not attending the final exam will be "non presentado"

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

- The exams corresponding to the end-of-degree call, as well as any exam held on 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 (L, A, T and P) will hold its value to calculate the global mark G

- The date and hours for revision of marks and tests and exams 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 1982, MIR-Rubiños 1993,

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

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

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

In particular, it is highly recommended 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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

* Teaching methodologies modified
All the methodologies (lecturing, problem solving and laboratory practical): in the blended learning regime face-to-face classroom activities will be combined with on-line lecturing through the virtual campus (□Campus Remoto□), using FAITIC platform as an additional support. In the distance learning regime only online lecturing will take place through virtual

campus (Campus Remoto), using FAITIC platform as an additional support as well. To guarantee the access of the students to the materials and resources of the course other methodologies and media could be implemented if needed.

In particular, for the laboratory practical in the blended learning regime the operation of experimental devices by the students and the associated data acquisition activities could suffer major restrictions (due to the reduced effective capacity of the laboratory classroom, the mandatory use of personal protective equipment, the implementation of special hygiene measures and other factors). For these reasons, these activities will be mostly replaced by demonstrations developed by the lecturer in a session face-to-face with part of the students in a laboratory group. These demonstrations could be followed online by the rest of the students of the same group. Data processing and analysis are greatly independent of the operation of experimental devices and can be developed outside of the laboratory classroom (in another classroom, at home, etc..). In the distance learning regime, the laboratory practical will be developed entirely online and the operation of experimental devices and data acquisition activities will be completely replaced by demonstrations developed by the lecturer that could be followed online by the students. These demonstration could be complemented by other specific audiovisual materials.

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

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

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

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

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

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

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

* New tests

* Additional Information

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

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

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

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

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Laboratory practical	6	7	13
Problem solving	12	18	30
Essay questions exam	3	0	3
Problem and/or exercise solving	0	12	12
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

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

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

Assessment		
	Description	Qualification Evaluated Competencess

Essay questions exam	Proof written that it will be able to consist of: - theoretical questions - practical questions - Resolution of exercises/problems - Short covering of a topic	80	CG3	CE8	CT2 CT9 CT10
Problem and/or exercise solving	Resolution of exercises proposed, including: -Short reports/exercises proposed	20	CG3	CE8	CT2 CT9 CT10
(*)	-	-			

Other comments on the Evaluation

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

Continuous assessment grading is not saved year after year

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

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

Ethical Commitment: In case of noticing a non ethical behaviour (copy, plagiarism, utilisation of unauthorised electronic devices,and others) it will be considered that the student does not gather the necessaryrequirements to pass the course. In this case, the global qualification iof the present academic course will be failed (0.0)

Sources of information

Basic Bibliography

Viedma A., Zamora B., **Teoría y Problemas de máquinas hidráulicas**, 3º Ed., Horacio Escarabajal Editores., 2008
Mataix, C., **Turbomáquinas Hidráulicas**, Editorial ICAI, 1975
Mataix, C., **Mecánica de Fluidos y Máquinas Hidráulicas**, Editorial del Castillo S.A., 1986
Srinivasan, K.M., **rotodynamic Pumps**, New Age International Publishers, 2008

Complementary Bibliography

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

Contingency plan

Description

EXCEPTIONAL PLANNING
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishesan extraordinary planning that will be activated when the administrations and the institution itself determine it, consideringsafety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee,at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well inadvance) by the students and teachers through the standardized tool.

ADAPTATION OF THE METHODOLOGIES

Teaching methodologies maintained: Lecturing and tutoring. In any case, if it is needed, they will be substituted by distance learning, using CAMPUS REMOTO or any other available platform

Teaching methodologies modified: Laboratory. This will be substituted by explanatory videos or additional teaching material to explain the different topics

Non-attendance mechanisms for student attention (tutoring): Telematic technology will be used, such as CAMPUS REMOTO or any other available platform, to get in contact with the students

Modifications (if applicable) of the contents: None

Additional bibliography to facilitate self-learning: None

Other modifications: Assessment criteria does not change.

ADAPTATION OF THE TESTS
If it is needed, final exam will be substituted by 2 or 3 continuous evaluation tests. These tests can comprise test questions (true or false or several choices) or exercise to solve through Faitic or Campus Remoto in a limited period of time

IDENTIFYING DATA				
Matemáticas da especialidade				
Subject	Matemáticas da especialidade			
Code	V12G363V01505			
Study programme	Grao en Enxeñaría en Tecnoloxías Industriais (Inglés)			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3	1c
Teaching language				
Department	Matemática aplicada I			
Coordinator	Vidal Vázquez, Ricardo			
Lecturers	Vidal Vázquez, Ricardo			
E-mail	rvidal@uvigo.es			
Web				
General description				

Competencias
Code

Resultados de aprendizaxe	
Learning outcomes	Competences

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

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

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

Atención personalizada

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

Avaliación

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

Other comments on the Evaluation

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

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

COMPROMISO ÉTICO:

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

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

Complementary Bibliography

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

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

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

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

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

Plan de Continxencias

Description

=== MEDIDAS EXCEPCIONAIS PLANIFICADAS ===
Ante a incerta e imprevisible evolución da alerta sanitaria provocada pola COVID- 19, a Universidade establece una planificación extraordinaria que se activará no momento en que as administracións e a propia institución o determinen atendendo a criterios de seguridade, saúde e responsabilidade, e garantindo a docencia nun escenario non presencial ou non totalmente presencial. Estas medidas xa planificadas garanten, no momento que sexa preceptivo, o desenvolvemento da docencia dun xeito mais áxil e eficaz ao ser coñecido de antemán (ou cunha ampla antelación) polo alumnado e o profesorado a través da ferramenta normalizada e institucionalizada das guías docentes DOCNET.

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

IDENTIFYING DATA				
Machine design and testing				
Subject	Machine design and testing			
Code	V12G363V01602			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician English			
Department				
Coordinator	Segade Robleda, Abraham Casarejos Ruiz, Enrique			
Lecturers	Casarejos Ruiz, Enrique Segade Robleda, Abraham			
E-mail	asegade@uvigo.es e.casarejos@uvigo.es			
Web	http://faitic.uvigo.es			
General description	This subject is intended to allow the students to apply the fundamentals of Mechanism and Machines Theory to the design of machines as well as the necessary knowledge, comprehension, and application of these concepts concerning to the field of Mechanical engineering. It also provides the students with the most important concepts related to the design of machines. The students will know and apply analysis methods for the design of machines by applying analytical methods or/and through the effective use of simulation software.			

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

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

Contents
Topic

Mechanical design	1. Design vs. static loads 2. Design vs. dynamic loads
Power Transmissions	3. Introduction to power transmission systems 4. Gears (spur, bevel, and worm gears) 5. Axles and shafts
Machine elements	6. Clutches and brakes 7. Bolted joints and power screws 8. Plain and ball bearings

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	23	19.5	42.5
Problem solving	9	30	39
Laboratory practical	18	47	65
Objective questions exam	3.5	0	3.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

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

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

Assessment					
	Description	Qualification		Evaluated Competencess	
Laboratory practical	Attendance and participation as well as practices reports, papers, and tests will be rated. However, to be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points. Learning outcomes: all will be graded	20		CE13 CE26	CT2 CT9 CT16 CT20
Objective questions exam	Final and mid-term tests will be focused on the contents taught at classes and laboratory sessions. Learning outcomes: all will be graded	80	CG3 CG4 CG5 CG6 CG11	CE13 CE26	CT2 CT9 CT16

Other comments on the Evaluation

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

- Laboratory Practical.
    - Students are required to attend and utilized the laboratory/Computer room. Practices reports, papers, and tests for each practice session as well as proposed works/papers from tutorials will be evaluated and graded with a maximum of 2 points. This grade will be kept for the second term in the student's evaluation records (July). To be evaluated, students must attend a minimum of 7 practice sessions; otherwise, students won't be evaluated and will get 0 points.
    - For those students who have been officially granted the right to waive their continued evaluation, there will be a mandatory final test where they will be able to get a maximum grade of 2 points. However, an advanced request must be made to the professor to prepare the necessary materials for this test.
- Objective question exam. It will be graded in a test that have a minimum grade of 8 points.

(*) Grades are calculated using a system of numerical qualification from 0 to 10 points conforming to the Spanish current legislation (RD 1125/2003, 5 September; BOE 18 September).Ethical commitment: An adequate ethical behaviour of the student is expected at all times. In case an unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, and others); the student will be considered unfit to meet the necessary requirements to pass the subject. In this case, the overall qualification in the current academic year will be a Fail grade (0.0).

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

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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

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

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

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

Recommendations

Subjects that it is recommended to have taken before

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

In the event that attendance to classes become legally entirely or partially limited, the measures set on place will be:

1. To guarantee the necessary means, namely personal computer or internet access, to every enrolled student so they can follow the distance learning classes, appropriately. Therefore, to apply the appropriate solutions, any student who does not have any of these means should inform the course coordinator.

2. To inform students of the different measures adopted, the department will use the platform, Faitic.

3. On top of that, in the case of cancelation of face-to-face classes, the teaching guide will show the next modifications:

A. Competences. They will not be modified.
B. Learning outcomes. They will not be modified.
C. Contents. They will not be modified.
D. Planning. It will not be modified.

E. Methodology. It will be modified:
Lecturing and Problem solving. They will require the employment of electronic means (virtual classroom of the Remote Campus or others).
Laboratory Practices. The department will provide every student access to CAD and FEM software, so that they can carry out the practices remotely instead of from the Mechanical Engineering laboratory. The professor will supervise these practices

using electronic means (virtual classroom of the Remote Campus or others).

F. Tutoring Lessons. They will be carried out by previously arranged electronic means (e-mail, faitic forums or virtual classroom at campus remote,).

G. Assessment. Assessment methodologies/test will not be modified: Laboratory practical and Essay questions exam. Description, qualification, and competences, they will not be modified. All exams will use electronic means (virtual classroom of the Remote Campus or others); the department will publish in advance the specific rules for each test in the platform, Faitic. According to attendance at the virtual practice sessions, the professor will compute and validate each practice attendance on virtual classroom of the Remote Campus.
Partial tests for the evaluation of specific contests of the subject can be proposed. Once again, the professor will publish in advance the rules concerning each test in the platform, Faitic.

H. Bibliography. Besides the bibliographical references found in this guide, the documentation provided at Faitic, and the problem bulletins and previous exams, the professor might facilitate additional notes, videos, web-references, and others, so that students can appropriately follow the course during the non-face-to-face classes.

This guide can be modified following Rectoral rules.

IDENTIFYING DATA				
Elasticity and additional topics in mechanics of materials				
Subject	Elasticity and additional topics in mechanics of materials			
Code	V12G363V01603			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Comesaña Piñeiro, Rafael			
Lecturers	Comesaña Piñeiro, Rafael Riveiro Rodríguez, Antonio			
E-mail	racomesana@uvigo.es			
Web				
General description	This course will study the fundamentals of elasticity and deepen the study of mechanics of materials in order to be able to apply their knowledge to the actual behavior of solids (structures , machinery and resistant elements in general). This course, along with mechanics of materials course, is a holder of more specialized subjects whose object is the mechanical design.			

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

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

Contents	
Topic	
Fundamentals of elasticity	Introduction to the theory of elasticity Stress analysis of elastic solids Strain Stress-strain relationships Two-dimensional elasticity

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

Planning

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

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

Methodologies

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

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

Personalized assistance

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

Assessment

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

Other comments on the Evaluation

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

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

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

preserved in the current year, provided the student requests that within an established period in the beginning of the course.

The qualification obtained in the conceptual tests in any of the two previous years (15% of the qualification) will be preserved in the current year, provided the student requests that within an established period in the beginning of the course.The rating obtained only remain within the language chosen at the time in which he studied the subject.

Comments about continuous assessment:

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

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

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

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

Additional comments:

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

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

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

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

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

Group responsible lecturer: Groups with teaching in Spanish: Marcos García González and Adrián Pérez Riveiro.

Group with teaching in English: Rafael Comesaña and Antonio Riveiro

Reading list for the group in English:

Recommended:

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

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

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

Complementary:

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

- Manuel Vázquez , Resistencia de Materiales.

Sources of information

Basic Bibliography

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

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

Manuel Vázquez, **Resistencia de Materiales**,

Complementary Bibliography

Luis Ortiz Berrocal, **Elasticidad**,

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

Recommendations

Subjects that it is recommended to have taken before

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

Other comments

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

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

Contingency plan

Description

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

=== ADAPTATION OF THE METHODOLOGIES ===

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

Theory sessions:

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

Laboratory sessions:
The carrying out of experimental practices will be replaced by non-contact activities to solve similar problems that may require the use of specific calculation / simulation software.

Tutorials:

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

Evaluation:

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

IDENTIFYING DATA				
Manufacturing engineering				
Subject	Manufacturing engineering			
Code	V12G363V01604			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Fenollera Bolíbar, María Inmaculada			
Lecturers	Fenollera Bolíbar, María Inmaculada			
E-mail	mfenollera@uvigo.es			
Web				
General description				

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CE20	CE20 Applied knowledge of systems and manufacturing processes, metrology and quality control.
CT2	CT2 Problems resolution.
CT8	CT8 Decision making.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.
CT20	CT20 Ability to communicate with people not expert in the field.

Learning outcomes	Competences		
- Know the technological basis and the basics of manufacturing processes	CG3	CE20	CT2
- Understand the basics of manufacturing systems			CT8
- Acquire skills for the selection of manufacturing processes and developing manufacturing planning			CT9
			CT10
- Develop skills for making assemblies and parts in CADCAM environments			CT17
- Application of CAQ technologies			CT20

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Problem solving	18	16	34

Laboratory practical	18	0	18
Mentored work	0	60	60
Lecturing	14	14	28
Objective questions exam	2	0	2
Essay	2	0	2
Essay questions exam	2	2	4

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

Methodologies

	Description
Introductory activities	- Introduction - Objectives - Theoretical classes - Practical classes - Assesment - Project development. Topic selection and work progress. - References
Problem solving	Development of real practical cases and exercises on the following contents 1. Plant distribution 2. Product and tools design 3. DFMA application 4. Application of dimensional, geometrical and surface finishing tolerances. 5. Sequence of manufacturing operations. 6. Setting of the conditions in manufacturing processes. 7. Calculation of cutting speeds, feeds, strengths and cutting powers in manufacturing. 8. Measurement procedures.
Laboratory practical	P1-2. PLM introduction. Product and process design. CAD software. Available software: Catia, NX, Fusion. 2 hour +2 hour P3. Part manufacturing process planning. Tooling design for product. 2 hour P4 -5 -6. Computer-aided tooling manufacturing, CAM prismatic, (Catia, NX, Fusion). 6 hour P7 -8 -9 Supervision of project development. 6 hour
Mentored work	Project (Work to make by student. It would correspond to Groups C of 5 students) Total 18*h
Lecturing	Development of the contents of the subject Proposition real cases and problems

Personalized assistance

Methodologies	Description
Mentored work	Attending Works and supervising projects (groups from among 3 and 5 people).

Assessment

	Description	Qualification	Evaluated Competencess		
Objective questions exam	- Test-type questions, marks will be deducted for incorret answer. - The test can involve problem and essay type questions.	50	CG3	CE20	CT2 CT8 CT9
Essay	Project development. Teamwork, creativity, self-sufficiency will be evaluated and in case of public presentation the ability for synthesis and communication	50		CE20	CT2 CT9 CT10 CT17 CT20
Essay questions exam	- Development of problems and/or cases.	50		CE20	CT2 CT8 CT9 CT10

Other comments on the Evaluation

The evaluationconsists of:

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

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

B1.-)Project. Value 50%

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

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

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

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

ethical Commitment: it expects that the present student a suitable ethical behaviour. Inthe case to detect a no ethical behaviour (copy, plagiarism, utilisation ofunauthorised electronic devices, and others) will consider that the student does not gather the necessary requirements to surpass the matter. In this case theglobal qualification in the present academic course will be of suspense (0.0).

Sources of information

Basic Bibliography

Complementary Bibliography

Pereira A., Prado T., **Notes of the subject IF**, 2015,

Pereira A., **Exercises and cases of manufacturing Engineering**, 2016,

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

Notes of the ME subject,

Recommendations

Subjects that it is recommended to have taken before

Fundamentals of manufacturing systems and technologies/V12G360V01402

Other comments

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

Contingency plan

Description

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

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies that are maintained:
All. Excepting virtual clases.
* Non-face-to-face classes (tutorials):
Through virtual office on remote campus
* Additional bibliography to facilitate self-learning:
Necessary educational resources will be published on faitic platform

=== ADAPTATION OF THE EVALUATION ===
* Tests already carried out:
They are all kept with the same weight and value
* Pending tests that are maintained:
They will be carried out virtually through faitic platfporm, keeping the same weight and value

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

Competencies
Code

Learning outcomes	
Learning outcomes	Competences

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Problem solving	8	16	24
Laboratory practical	10	16	26
Lecturing	32.5	65	97.5

Objective questions exam	1	0	1
Problem and/or exercise solving	1.5	0	1.5

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

Methodologies

	Description
Problem solving	Student will be required to work in groups to solve and present some proposed ac machines problems. This activity could be done using the "virtual office" if presentiality is not posisible due to the COVID19 University self-quarantine polilcies
Laboratory practical	Typical lab session in the Electrical Machines laoratory. They can be done online (iusing some machine simulation software) if presentiality is not posisible due to the COVID19 University self-quarantine polilcies
Lecturing	Typical lecture. Either presential or using the "virtual office" facility. The place will depend on the COVID19 University self-quarantine polilcies

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated Competencess
Problem solving	The assessment method will be a numerical resolution of some exercises of electrical machines A minimum mark of 40% will be required in this part Part of this qualification percentage could be obtained with some continuous evaluation, depending on the lecturer. (5/40). Student will be properly informed if this option is activated.	40	
Lecturing	The assessment method will be a test, to be done individually without the use of any information source. There will be one unique test for the whole subject, and it will cover not only the theoretical lessons but the practical lab tests. A minimum mark of 40% will be required in this part Part of this qualification percentage could be obtained with some continuous evaluation in the lab lessons, depending on the lecturer. (10/60). Student will be properly informed if this option is activated.	60	

Other comments on the Evaluation

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

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

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

Sources of information

Basic Bibliography

Complementary Bibliography

B. Novo, **Class notes**,

Any ac machines book,

Recommendations

Subjects that are recommended to be taken simultaneously

Automation and control fundamentals/V12G363V01304

Subjects that it is recommended to have taken before

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

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

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information

IDENTIFYING DATA				
Chemical technology				
Subject	Chemical technology			
Code	V12G363V01606			
Study programme	Degree in Industrial Technologies Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Sanroman Braga, María Ángeles			
Lecturers	Rosales Villanueva, Emilio Sanroman Braga, María Ángeles			
E-mail	sanroman@uvigo.es			
Web				
General description	In this subject, students learn the basic aspects of Chemical Engineering and the fundamentals of the basic operations most employed in industry.			

Competencies	
Code	
CG3	CG3 Knowledge in basic and technological subjects that will enable them to learn new methods and theories, and equip them with versatility to adapt to new situations.
CG4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CE4	CE4 Ability to understand and apply the basic knowledge of general chemistry, organic chemistry and inorganic chemistry, and their applications in engineering.
CT2	CT2 Problems resolution.
CT9	CT9 Apply knowledge.
CT10	CT10 Self learning and work.
CT17	CT17 Working as a team.

Learning outcomes	Competences		
To know the bases of chemical technology.	CG3	CE4	CT9
To apply mass and energy balances to real systems.	CG4	CE4	CT2 CT9 CT10 CT17
To know and understand the basic aspects of mass transfer.	CG3	CE4	CT9
To know the fundamentals of separation processes and their application to real cases.	CG4	CE4	CT2 CT9 CT10 CT17

Contents	
Topic	
Introduction	Chemical Engineering. Basic principles. Chemical processes. Unit conversion and calculation tools
Mass and energy balances	Mass balances for systems without chemical reaction. Mass balances for systems with chemical reaction. Energy balances
Implementation of balances into chemical reactor design	Stoichiometry. Reaction rate. Ideal reactors
Mass transfer	Introduction. Mass transfer equations: individual and global coefficients
Distillation and rectification of liquid mixtures	Vapour□liquid equilibrium. Simple distillation. Rectification. Azeotropic and extractive distillation.
Liquid-liquid extraction	Fundamentals. Binary and ternary mixtures. Factors that affect the separation. Operation by simple contact, multiple contact in direct current, multiple contact in multiple countercurrent
Other operations in chemical processes	Gas absorption. Liquid-solid extraction. Adsorption and ion exchange.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Problem solving	17	31	48
Laboratory practical	8	8	16
Problem and/or exercise solving	2	8	10
Report of practices, practicum and external practices	0	2	2
Essay questions exam	3.5	10.5	14

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

Methodologies

	Description
Lecturing	Direct oral exposition of the most important contents of the subject by the lecturer.
Problem solving	The lecturer suggests various problems to the students so they can work on them at home. Then, the lecturer solves them in the seminar classes.
Laboratory practical	The students will perform some experiments in the laboratory, solving problems in seminar classes and field practices in companies related to the topics covered throughout the course. In addition, the students will evaluate different processes using simulation software. The aim of the laboratory practices is to deepen basic concepts.

Personalized assistance

Methodologies	Description
Lecturing	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Problem solving	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.
Laboratory practical	The students can ask the lecturer any question about the theoretical and practical aspects of this subject, about this methodology and the correction of the assessment tests.

Assessment

	Description	Qualification	Evaluated Competencess		
Problem and/or exercise solving	The students will carry out various tests with problems and short-answer questions. The average mark will represent 30% of the final mark.	30	CG3 CG4	CE4	CT2 CT9
Report of practices, practicum and external practices	Apart from the mark of the practice report, the lecturer will take into account the attendance as well as the attitude that the students have on the practices.	10		CE4	CT9 CT10 CT17
Essay questions exam	Theoretical-practical exam of the basic concepts and procedures related to the subject matter, in the date fixed by the Centre.	60	CG3 CG4	CE4	CT2 CT9

Other comments on the Evaluation

The participation of the student in any of the evaluation systems of the subject will imply that the student effectively take the subject and its qualification.

To pass the subject, it is necessary that the student obtains a minimum of 5 points out of 10 in each of the proposed evaluation systems. In the case of students who do not attain the minimum in all evaluation systems, they will fail to achieve the pass mark, with a numerical value obtained by following the percentages of the evaluation systems described above, or equal to that obtained in the non passed part.

In July, the previous marks of the evaluation systems will be are kept if a minimum of 5 points out of 10 is achieved; therefore, the students will just have to take an essay or questions exam (theoretical-practical exam).

For students who are allowed by the School to skip the continuous assessment procedure: The qualification of these students will be formed by the mark of the essay & questions exam (90%) and the mark of the practices (10%).

Ethical commitment: The student is expected to present adequate ethical behaviour. In the event that unethical behaviour is detected (copying, plagiarism, unauthorized use of electronic devices, etc.), it will be considered that the student does not meet the necessary requirements to pass the subject. In that case, the overall rating in the current academic year will be □fail (0.0)□. The use of any electronic device for the assessment exams is not allowed unless explicitly authorised. The fact of introducing unauthorised electronic devices in the examination room will be considered as a reason for not to pass the subject in the current academic year and will hold overall rating (0.0)

Sources of information

Basic Bibliography

Himmelblau, D.M., **Basic principles and calculations in chemical engineering**, 6th,

Felder, R.M. y Rousseau, R.W., **Elementary principles of chemical processes**, 3rd,

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

Coulson, J.M. and others, **Chemical Engineering vol. 1 and vol 2**, 5th,

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

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

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

Wankat, P.C., **Ingeniería de procesos de separación**, 2ª,

McCabe, W.L., Smith, J.C. y Harriott, P., **Unit operations of chemical engineering**, 7th,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Mathematics: Calculus 1/V12G360V01104
Mathematics: Calculus 2 and differential equations/V12G360V01204
Chemistry: Chemistry/V12G360V01205

Other comments

Requirements: To enrol in this subject, it is necessary to have passed or be enrolled in every subject of inferior courses. In case of discrepancies, it will prevail the Spanish version of this document.

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will be activated in the moment that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in blended or distance learning mode. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance by the students and the teaching staff through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* educational Methodologies that keep
Lesson magistral: they will develop by means of synchronous virtual sessions that they will be able to be complemented with videos or other didactic materials.
Resolution of problems: it will be proposed to the students series of problems so that they work on them and that will be reviewed in synchronous virtual sessions.
Practices of Laboratory: it will make only by means of the evaluation of industrial chemical processes by means of the handle of a Chemical processes simulation software.
Educational Methodologies that modify
None adapt all the methodologies to the non face-to-face modality
* Mechanism non face-to-face of attention to the students tutoring.
differentiate two types of mechanisms non face-to-face of attention to the students: generals and individual.
Generals: The lecturers in the schedule established by the centre will connect in a virtual classroom to which will assist all the students and in which the lecturers will orient on the material supplied to the students or will expand concepts according to the established in the educational guide.
Individual: The lecturers will attend in their schedule of tutoring to the students in the virtual room.
* Modifications (if they proceed) of the contents to give
there are not modifications
* additional Bibliography to facilitate the self-learning
is not necessary
* Other modifications

=== ADAPTATION OF THE EVALUATION ===
* Test already made

Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Pending proofs that keep
Proof XX: [previous Weight 00%] [Weight Proposed 00%]
...

* Proofs that modify
[previous Proof] => [new Proof]

* New test

* additional Information
Vulnerable students: It will be made a methodological adaptation, facilitating them additional specific information when it is proved that they cannot have access to the contents provided by the conventional ways.

Evaluation: The systems of evaluation will be developed face to face except Resolution of the university board that indicate that they have to do innon face to face mode, making of this way through the different tools put to disposal of the teaching staff.