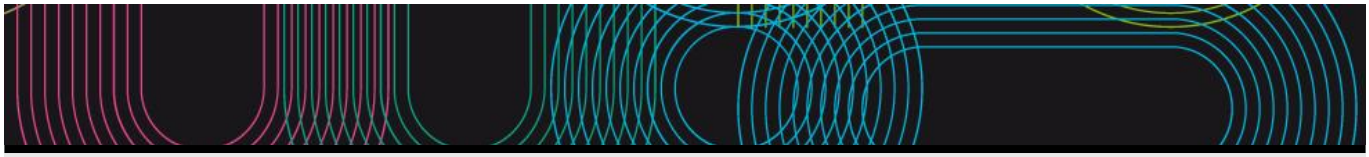

(*)Escola de Enxeñaría Industrial

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

Grado en Ingeniería en Química Industrial

Subjects

Year 3rd

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

IDENTIFYING DATA				
Fundamentos de organización de empresas				
Subject	Fundamentos de organización de empresas			
Code	V12G350V01501			
Study programme	Grao en Enxeñaría en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3	1c
Teaching language	Castelán			
Department				
Coordinator	Doiro Sancho, Manuel			
Lecturers	Doiro Sancho, Manuel García Lorenzo, Antonio			
E-mail	mdoiro@uvigo.es			
Web				
General description				

Resultados de Formación e Aprendizaxe	
Code	
B8	CG8 Capacidade para aplicar os principios e métodos da calidade.
B9	CG9 Capacidade de organización e planificación no ámbito da empresa, e outras institucións e organizacións.
C15	CE15 Coñecementos básicos dos sistemas de produción e fabricación.
C17	CE17 Coñecementos aplicados de organización de empresas.
D1	CT1 Análise e síntese.
D2	CT2 Resolución de problemas.
D7	CT7 Capacidade para organizar e planificar.
D8	CT8 Toma de decisións.
D9	CT9 Aplicar coñecementos.
D11	CT11 Capacidade para comprender o significado e aplicación da perspectiva de xénero nos distintos ámbitos de coñecemento e na práctica profesional co obxectivo de alcanzar unha sociedade máis xusta e igualitaria.
D18	CT18 Traballo nun contexto internacional.

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

Contidos	
Topic	
PARTE I. CONTORNA ACTUAL E SISTEMAS PRODUTIVOS	1.CONTORNA ACTUAL DE A EMPRESA.Os SISTEMAS PRODUTIVOS
PARTE II. PREVISIÓN DE A DEMANDA	2. INTRODUCIÓN. COMPOÑENTES. MÉTODOS DE PREVISIÓN DE A DEMANDA: CUANTITATIVOS E CUALITATIVOS
PARTE III. XESTIÓN DE INVENTARIOS E XESTIÓN DE PRODUCIÓN	3.CONCEPTOS BÁSICOS DE Os INVENTARIOS. CONTROL DE INVENTARIOS 4.XESTIÓN DE INVENTARIOS. MODELOS BÁSICOS
PARTE *IV. XESTIÓN DE PRODUCIÓN EN EMPRESAS INDUSTRIAIS	5.PLANIFICACIÓN DE PRODUCIÓN. PLAN AGREGADO. PLAN MESTRE DE PRODUCIÓN 6.PLANIFICACIÓN DE NECESIDADES DE MATERIAIS (*MRP) 7.PLANIFICACIÓN DE CAPACIDADE. 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	Training and Learning Results		
Exame de preguntas obxectivas	2 Teórico-Prácticas de igual peso: Probas de avaliación continua que se realizarán a o longo do curso, nas clases de teoría, distribuídas de forma uniforme e programadas para que non interfiran no resto das materias. Cada unha destas probas (puntuación sobre 10) constarán dunha parte tipo test (5 puntos) e doutra de exercicios (5 puntos). Para poder superar ou compensar dita proba hai que alcanzar en cada unha das partes polo menos 1,75 puntos	60	B8 B9	C15 C17	D1 D2 D7 D8 D9 D18
Práctica de laboratorio	1 Exercicios de prácticas: Proba de avaliación continua que se realizará de acordo con a planificación da materia ao finalizar as sesións prácticas	40	B8 B9	C15 C17	D1 D2 D7 D8 D9 D18

Other comments on the Evaluation

COMPROMISO ÉTICOEspérase que o alumno presente un comportamento ético adecuado. En cáso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0). Non se permitirá a utilización de ningún dispositivo electrónico durante as probas de avaliación salvo autorización expresa. O feito de introducir un dispositivo electrónico non autorizado no aula de exame será considerado motivo de non superación da materia no presente curso académico e a cualificación global será de suspenso (0,0)

OUTROS COMENTARIOS

En todos os casos, en cada proba (teórico-práctica ou de exercicios) debe alcanzarse un mínimo de 4 puntos para que se poida compensar con o 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: 1. É imprescindible realizar con aproveitamento as prácticas da materia asistindo ás mesmas e entregando a resolución dos exercicios propostos. Só se permitirán 2 faltas a o longo de todo o curso, debéndose entregar a resolución das mesmas correctamente. 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. 2. Débense superar (e/o compensar) todas as probas (teórico-prácticas e de exercicios). Os alumnos que superen a Avaliación Continua quedarán exentos das convocatorias oficiais. Con todo, 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 superen a avaliación continua e teñan soamente una das tres probas pendente, poderán recuperar esta unicamente na convocatoria de Xaneiro/Xuño. No resto dos casos: a) Aqueles alumnos que desenvolvan con aproveitamento as prácticas (é dicir, que asistan e entreguen as resolución das mesmas), realizarán unha proba reducida cun parte teórico-práctica (60% da nota) e outra de exercicios (40% da nota). b) 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 teórico-prácticas 60% e proba de Exercicios de prácticas 40%). En calquera caso, para superar a materia é condición necesaria superar todas a partes ou ben ter unha media de aprobado sen que ningunha das notas sexa inferior a 4 (nota mínima para compensar). Nos casos nos que a nota media sexa igual ou superior ao valor de aprobado pero nalgunha das 3 probas non se alcanzou o valor mínimo de 4, a cualificación final será de suspenso. A modo de exemplo, un alumno que obteña as seguintes cualificacións: 5, 9 e 1 estaría suspenso, aínda cando a nota media dá un valor de 5, ao ter unha das partes por baixo da nota de corte (4). Nestes casos, a nota que se reflectirá no acta será de suspenso (4).

Bibliografía. Fontes de información

Basic Bibliography

Chase, R.B y Davis, M.M., **Administración de Operaciones. Producción y cadena de suministros**, McGraw-Hill, 2014

hase, R.B y Davis, M.M., **Administración de Operaciones. Producción y cadena de suministros**, McGraw-Hill, 2014

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

Complementary Bibliography

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

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

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

Recomendacións

Other comments

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

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

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G350V01502			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Subject that belongs to the Block of Common Subjects of the Industrial Technologies. It is part of the curricula of all Degrees of Industrial Engineering. This subject provides an approach to Environmental Engineering, which is necessary to develop any engineering project. In it we work areas of Chemistry and Process Engineering, in order to study the pollutants behaviour and their effect on the environment and organisms, to design physical-chemical processes to mitigate pollution, as well as to evaluate the environmental impact of the industrial wastes. The subject's objective is to know, understand, and know how to apply the techniques used, on an industrial scale, in fields such as solid wastes treatment and management, wastewater treatment, soil remediation, treatment of polluting gas industrial emissions, and pollution prevention.			

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

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

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

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Problem solving	11	22	33
Laboratory practical	12	12	24
Objective questions exam	1	0	1
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	6	6
Case studies	0	6	6

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

Methodologies	
	Description
Lecturing	Teaching in the classroom of the key concepts and procedures for learning the syllabus contents
Problem solving	Solving exercises with the teacher's help and independently
Laboratory practical	Application of the knowledge acquired to the resolution of problems of environmental technology, using equipment and facilities available in the laboratory/computer room.

Personalized assistance	
Methodologies	**Description**
Laboratory practical	In tutorials, students can consult with their teacher any questions about laboratory practices or the report of practices to be done. The tutoring schedule of the teaching staff will be public and accessible to the students.
Lecturing	In tutorials, students can consult with their teacher any questions arising in the lectures and related to the contents seen in them The schedule of tutorials of teachers will be public and accessible to students.
Problem solving	In tutorials, students can consult their teacher any questions about the resolution of problems raised in the classroom. The tutoring schedule of the teaching staff will be public and accessible to the students.

Assessment				
	Description	Qualification	Training and Learning Results	
Objective questions exam	Written test in which students must answer theoretical questions related to tha syllabus of the subject. CG7, CE16 and CT19 competences will be assessed in this test, based on student responses to the questions. CT1, CT3 and CT10 competences are also evaluated, since the test is written and requires students' analysis and synthesis skills.	30	B7 C16	D1 D3 D10 D19
Problem and/or exercise solving	Written proof in which students must solve several problems related to the syllabus of the subject. CT2, CT9 and CT19 competences will be assessed in this proof, based on the resolution of various exercises of environmental technology, which require the use of applied knowledge related to the contents of the subject. CT1, CT3 and CT10 competences are also evaluated, since the proof is written and requires students' analysis and synthesis skills.	30		D1 D2 D3 D9 D10 D19
Report of practices, practicum and external practices	Detailed report for each practices that includes an explanation of the experimental work, as well as the results obtained, their analysis and the conclusions drawn from them. The laboratory practices are in teams of 2 students, but the report will be given individually. A report submitted by a student who did not previously do the practical in the laboratory will not be evaluated under any circumstances. In the computer classroom practices, each student will work individually and, consequently, the reports will also be individual. Similarly, only the report handed by a student who has previously attended the corresponding practical session will be assessed. The competences: CG7, CE16, CT1, CT3, CT9 and CT10, are assessed based on the quality of the written report elaborated by each student on his/her own. The following points will be evaluated in the report: text style and correctness, structure and presentation, analysis and discussion of the results, and conclusions. Competences CT12 and CT17 will be assessed based on the laboratory work. Lab practices will be carried out in pairs, and it is expected the student develop research skills in the field of environmental technology.	10	B7 C16	D1 D3 D9 D10 D12 D17

Case studies	All exercises, seminars, practical cases and theoretical / practical tests that are made and delivered to the teacher throughout the course, related to the concepts and contents of the syllabus. Throughout a four-month time several tests are performed. Competences CG7 and CE16 will be assessed considering the students answers to the theoretical questions. Competences CT2, CT10 and CT12 will be assessed considering the students answers to the exercises. Competenci CT3 will be assessed base on the two parts of the exam: theory and exercises; considering the precision and clarity of the answers.	30	B7 C16	D2 D3 D10 D12

Other comments on the Evaluation

Evaluation

A student who choose continuous assessment, to pass the course, must achieve a **MINIMUN SCORE** of **4.0 points** (out of 10) ***in all the evaluation tests detailed in this guide***, ie, "Objective questions exam", "Problem and/or exercise solving", "Case studies" and "Report of practices". If a student reaches the minimum grade, to pass the subject must obtain a FINAL GRADE of ≥ 5.0, that is, when the sum of grades of the "practice report", "Case study", "Objective questions exam" and the "Problem solving and/or exercises" is ≥ 5.0.

Students who "officially renounces continuous assessment", will make a "FINAL EXAM" (Objective questions exam + Problem and/or exercise solving) that will be worth 90% of the final grade, and a "EXAM OF PRACTICES" that will be worth 10% of the final grade. In any case, to pass the course, the student must achieve 50% of the maximum score in each of the constituent parts of the subject, ie, theory, problems and practices.

In addition, if a student misses more than 1 "laboratory practice", without a justified cause, in order to pass the course, he/she will have to do an exam of the practices that he/she did not do.

Second call:

In the second call the same criteria apply.

In relation to the July exam, the grade of "Case study" and "Practical report" will be kept, as soon as the student achieved the required minimum grade in the 1st call.

For the "Oobjective questions exam" and the "Resolution of problems and/or exercises" if, at the 1st call, a student suspended one of the test and approves the other with a grade ≥ 6, on the July exam, you only need to repeat the suspended part.

Ethical commitment:

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

The use of electronic devices during the assessment tests will be allowed. The fact of introducing into the examination room an unauthorized electronic device, will be reason not pass the course in the current academic year, and the final grade will FAIL (0.0 points)

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

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Castells et al., **Reciclaje de residuos industriales: residuos sólidos urbanos y fangos de depuradora**, Díaz de Santos, 2009
Albergaria, J.M. and Nouws H.P.A., **Soil remediation**, Taylor and Francis, 2016
Sharma, H. D., and Reddy, K. R., **Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies**, John Wiley & Sons, 2004
Wark and Warner, **Contaminación del aire: origen y control**, Limusa, 1996
Jonker, G. y Harmsen, J., **Ingeniería para la sostenibilidad**, Reverté, 2014
Azapagic, A. and Perdan S., **Sustainable development in practice: Case studies for engineers and scientists**, Wiley, 2011
Reddy, K.R., Cameselle, C. and Adams, J.A., **Sustainable Engineering: Drivers, Metrics, Tools, and Applications**, Wiley, 2019

Recommendations

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405
Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Chemistry: Chemistry/V12G380V01205

Other comments

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

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

Resultados de Formación e Aprendizaxe	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C19	CE19 Coñecementos sobre balances de materia e enerxía, biotecnoloxía, transferencia de materia, operacións de separación, enxeñaría da reacción química, deseño de reactores, e valorización e transformación de materias primas e recursos enerxéticos.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecer e aplicar os principios das operacións de separación controladas pola transferencia *simultanea de materia e enerxía e pola transferencia de cantidade de movemento.	B3 B4	C19	D2 D6 D9 D10 D17
Coñecer e aplicar as principais operacións complementarias da industria da contorna e a súa influencia sobre os produtos.	B3 B4	C19	D2 D6 D9 D10 D17

Contidos
Topic

Operacións de separación controladas pola transferencia simultánea de materia e enerxía: Secado	*ST1. Conceptos xerais. *ST2. Secado de materiais: Parámetros característicos; Cinética; Cálculo da velocidade e tempo de secado; equipos. *ST3. Liofilización.
Operacións de separación controladas pola transferencia de cantidade de movemento: sedimentación, precipitación, filtración	*ST1. Procesos de separación físico-químicos. *ST1.1 Filtración Conceptos xerais, Parámetros característicos; equipos *ST1.2 Precipitación e Sedimentación. Conceptos xerais, Parámetros característicos; equipos
Operacións de separación controladas pola transferencia simultánea de materia e de cantidade de movemento: Membranas	*ST2: Operacións de separación con membranas Teoría básica. Propiedades, Criterios de deseño; Aplicacións; *ST3. Fluidización Tipos de fluidización en leitos; Criterios de deseño; Expansión de leitos fluidizados

Planificación

	Class hours	Hours outside the classroom	Total hours
Lección maxistral	16.5	19.5	36
Resolución de problemas	16.5	28	44.5
Prácticas de laboratorio	11	18	29
Traballo tutelado	1.5	18.5	20
Resolución de problemas de forma autónoma	0	15	15
Presentación	1.5	0	1.5
Resolución de problemas e/ou exercicios	1.5	0	1.5
Exame de preguntas obxectivas	1.5	0	1.5
Exame oral	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	Desenvolveranse nos horarios fixados pola dirección do centro. A través desta metodoloxía farase a presentación estruturada dos temas co fin de facilitar información organizada. Consistirá na exposición por parte do profesor dos contidos teóricos e prácticos da materia, mediante o uso de medios audiovisuais. Estimularase a participación dos/*as alumnos/*as a través da *formulación/contestación de preguntas, exposición de puntos de vista, etc
Resolución de problemas	A través desta metodoloxía realizarase a resolución de exemplos e exercicios ilustrativos da materia impartida nas sesións maxistrais co fin de facilitar a comprensión do material dado nas sesións maxistrais. Buscarase a interacción profesor-alumno solicitando a participación do alumno na resolución activa dos exercicios.
Prácticas de laboratorio	Realizaranse experiencias de laboratorio relacionadas co temario da materia. O alumno disporá dos guións de prácticas así como do material de apoio necesario para unha adecuada comprensión dos experimentos a levar a cabo. O alumno elaborará un informe final no que deberá recoller os principais resultados e conclusións
Traballo tutelado	Ao longo do curso, os alumnos desenvolverán un traballo en grupo, CASO PRÁCTICO, relacionado coa temática da materia que será proposto polo profesor utilizando como material de partida o temario do curso.
Resolución de problemas de forma autónoma	Exporase a resolución de problemas relacionados coa materia, que serán resoltos mediante as ferramentas propostas na materia.

Atención personalizada

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

Avaliación

	Description	Qualification	Training and Learning Results		
Resolución de problemas	Traballos e exercicios propostos polo profesor que comprendan os conceptos e procedementos craves contidos no temario	20	B3	C19	D2 D6 D9 D10
Prácticas de laboratorio	Os estudantes realizarán diversas prácticas de laboratorio. Ao finalizar as diversas prácticas e nas datas indicadas deberán entregar os informes de prácticas e realizar un cuestionario sobre as saídas.	10	B3 B4		D9 D17
Traballo tutelado	Os estudantes formando grupos de traballo realizarán unha tarefa teórico/experimental da que deberá entregar unha memoria e realizar unha defensa pública.	10	B4	C19	D10 D17
Presentación	Os estudantes deberán realizar a exposición do traballo tutelado realizado que será avaliado por un tribunal composto polos profesores da área	10	B3 B4		D9 D17
Resolución de problemas e/ou exercicios	A resolución de problemas é unha parte esencial desta materia, polo que no exame final avaliarase os coñecementos do alumno mediante a resolución de problemas	20	B3 B4	C19	D2 D9
Exame de preguntas obxectivas	No exame final o estudante terá que responder a unha serie de preguntas curtas ou cuestiones tipo test nas que terá que demostrar os seus coñecementos así como a súa capacidade de síntese. Así mesmo, ao longo do cuadrimestre poderanse realizar exames tipo test que poderán supor até 1/2 da nota asignada a este apartado.	20	B3	C19	D9
Exame oral	Realizarase un exame oral das prácticas de laboratorio realizadas na materia	10	B3 B4		D9

Other comments on the Evaluation

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

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

Consideracións sobre a Avaliación Continua

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

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

Prácticas de laboratorio (20%): durante o cuadrimestre os estuduntes realizarán prácticas de laboratorio que suporán un 20% da nota final de materia. A nota total das prácticas dividirase da seguinte maneira: 8% exame oral individual das prácticas, 8% a memoria de prácticas, 4% asistencia, actitude e comportamento. Requírese unha asistencia mínima o 80% das prácticas para ter dereito á avaliación das mesmas. En caso contrario a nota deste apartado será 0,0 e terán que realizar un exame das mesmas no exame final.

Probas teóricas e problemas (20%,20%): ao longo do cuadrimestre poderanse realizar probas teóricas e de problemas que poderán ter un valor de até o 75% da nota asignada ao exame de preguntas obxectivas.

NOTA FINALA nota final será a suma das notas obtidas en cada apartado a condición de que se alcance unha nota mínima no exame (50% da nota máxima). De non alcanzar a nota mínima no exame, está será a calificación que figurará na acta. A participación do estudante nalgún dos actos de avaliación da materia implicará a condición de presentado/a e, por tanto, a asignación dunha cualificación en actas. Para superar a materia, o alumnado deberá obter como mínimo unha cualificación de 5 puntos sobre 10 en todos os apartados de avaliación (prácticas de laboratorio, traballo, exames). Así, a cualificación global necesaria para aprobar a materia, resultante da suma ponderada de todos os apartados de avaliación, será de 5 puntos sobre 10.

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

SEGUNDA CONVOCATORIA

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

Si ao alumno élle concedida a renuncia a avaliación continua unicamente será avaliado por un exame final dos contidos da materia (teóricos e prácticos) que será o 100% da nota.
Consideracións sobre estudantes con renuncia á avaliación continua (*EVALUACION GLOBAL): Estudantes con renuncia á avaliación continua realizarán un exame final composto de cuestións teóricas, de problemas e de prácticas. O exame suporá o 100% da nota, e para superar a materia esíxese un mínimo de 5 puntos sobre 10 en todas as partes da proba.
Compromiso ético: Espérase que o/o alumno/a presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o/o alumno/a non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0).

Bibliografía. Fontes de información

Basic Bibliography

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

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

Joaquín Ocón García, Gabriel Tojo Barreiro, **Problemas de Ingeniería Química: Operaciones Básicas. Tomo I y Tomo II**, 8403209975, Aguilar, 1982

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Treybal, Robert E., **Operaciones de Transferencia de masa**, 968-6046-34-8, 2ª, McGraw-Hill, 1994

Tejerina, F: Arribas, J.L.; Martínez, L.; Martínez, F.: Hernández Ramón, M.A., **Microfiltración, ultrafiltración y ósmosis inversa**, 9788476842120, Universidad de Murcia, 1990

Recomendacións

Subjects that it is recommended to have taken before

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

Other comments

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

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

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

Training and Learning Results	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.

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

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

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

Planning

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

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

Methodologies

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

Personalized assistance

Methodologies	Description

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

Assessment

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

Other comments on the Evaluation

Details about evaluation and qualifications

1. Considerations on continuous evaluation.

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

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

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

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

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

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

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

3. Considerations on the qualification records

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

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

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

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

Ethical considerations

The student is expected to exhibit an adequate ethical behavior. In case of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, and others), it will be considered that the student does not meet the necessary requirements to pass the subject. In this case, the overall grade in the current academic year will be Fail (0.0).

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

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

Lecturer acting as course coordinator: María Salomé Álvarez Álvarez

Sources of information

Basic Bibliography

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Recommendations

Subjects that continue the syllabus

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

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405

Other comments

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

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

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

Resultados de Formación e Aprendizaxe	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C21	CE21 Capacidade para o deseño e xestión de procedementos de experimentación aplicada, especialmente para a determinación de propiedades termodinámicas e de transporte, e modelaxe de fenómenos e sistemas no ámbito da enxeñaría química, sistemas con fluxo de fluídos, transmisión de calor, operacións de transferencia de materia, cinética das reaccións químicas e reactores.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Coñecer as técnicas do deseño experimental aplicado á industria química e de proceso.	B3 B4	C21	D10
Deseñar e gestionar procedementos de experimentación aplicada.	B3 B4	C21	D2 D6 D9 D10 D17
Analizar os resultados dos procedementos experimentais aplicados a casos reais	B3 B4	C21	D6 D9 D10

Contidos

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

Planificación

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

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

Metodoloxía docente

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

Atención personalizada

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

Avaliación

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

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

Other comments on the Evaluation

Criterios a seguir para a cualificación final

PRIMEIRA CONVOCATORIA

1. Estudantes que seguen a avaliación continua

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

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

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

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

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

2. Estudantes con renuncia oficial á avaliación continua

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

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

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

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

SEGUNDA CONVOCATORIA

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

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

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

Montgomery, D., **Design and analysis of Experiments**, 9, WIley, 2017

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

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

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

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

Complementary Bibliography

Recomendacións

Subjects that continue the syllabus

Experimentación en química industrial II/V12G350V01602

Subjects that are recommended to be taken simultaneously

Enxeñaría química II/V12G350V01503

Subjects that it is recommended to have taken before

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

Other comments

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

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

Training and Learning Results	
Code	
B3	CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering specializing in Industrial Chemistry.
C19	E19 Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery and processing of raw materials and energy resources.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D5	CT5 Information Management.

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

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

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

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

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

Personalized assistance	
Methodologies	**Description**

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

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	This matter is mainly practical, so the best way to evaluate the student's knowledge is by means of problem solving. Thus, throughout the four-month period, students will be assessed on the basis of exercise resolution deliverables	10	B3 B4	C19	D2
Laboratory practical	Students will carry out different laboratory practicals and field trips. At the end of the various practicals and on the dates indicated by the teachers, they will have to hand in the practical reports and complete a questionnaire on the field trips.	10	B3 B4		
Presentation	Students must present a CASE STUDY which will be assessed by an examining board made up of the lecturers of the subject.	10	B3 B4		D1
Case studies	Students will carry out a CASE STUDY as a group. Report will be worth 10% of the final grade.	10	B4		D1 D5
Essay questions exam	This subject is mainly practical, so in the final exam the student's knowledge will be assessed by solving problems.	30	B3 B4	C19	D2
Objective questions exam	In the final exam the student will have to answer a series of short questions or multiple-choice questions in which they will have to demonstrate their knowledge as well as their capacity for synthesis. In addition, during the four-month period, multiple-choice exams may be held, which may account for up to 1/4 of the grade assigned to this section.	20	B3		D1
Oral exam	There will be an individual oral examination of the laboratory practicals carried out in the course.	10	B3 B4		D1

Other comments on the Evaluation

CONTINUOUS ASSESSMENT

All students will be assessed on a continuous basis through the development of the CASE STUDY, practicals, multiplechoice questionnaires and problem solving.

Problem solving (10%): during the course, students will carry out different problem solving tasks, as well as multiple-choicetests.

CASE STUDY (20%): throughout the four-month period, students will have to carry out a group work in which they will use the different knowledge they are acquiring in the subject. The lecturer will plan seminars to monitor the work in which the progress of the work will be assessed. The partial evaluations of deliverables on the work carried out during the course as well as the evaluation of the final presentation of the work (report and presentation) constitute 20% of the mark for the subject, with 10% corresponding to the report and follow-up and 10% to the presentation.

Laboratory practicals and field trips (20%): During the four-month period, students will carry out laboratory practicals and field trips, which will account for 20% of the final mark for the course. The total mark for the practicals and field trips will be divided in the following way: 10% individual oral examination of the practicals and 10% the practical report and the test on field trips. A minimum attendance of 90% of the practices and field trips of the subject is required to be entitled to the evaluation of the same. Otherwise, the mark for this section will be 0.0 and the student will have to take a test in the final exam. Similarly, a minimum of 40% of the mark for the practicals must be achieved. If a minimum mark is not achieved in the practicals, an exam on the practicals must be taken during the final exam.

Multiple-choice questionnaires: throughout the term, multiple-choice questionnaires may be taken, which may be worth up to 1/4 of the mark assigned to the exam of objective questions.

FINAL MARK

The final mark will be the sum of the marks obtained in each section as long as a minimum mark is achieved in the sum of eassy questions exam and objective questions exam (50% of the maximum mark). If the minimum mark is not reached in the exam, this will be the mark that will appear in the final mark.

SECOND CALL

In the second call, the mark obtained in the practicals in the first call will be maintained (if 40% of the maximum mark is reached) and the mark obtained in the CASE STUDY and PROBLEM SOLVING will be maintained. Students who do not obtain 40% of the maximum mark in the practicals will have to take an exam in this second call.

RESIGNATION OF CONTINUOUS ASSESSMENT

If the student is granted permission to resign from continuous assessment, he/she will only be assessed by a final exam of the contents of the subject (theoretical and practical), which will be 100% of the mark.

ETHICAL COMMITMENT

Students are expected to behave ethically. If unethical behaviour is detected (copying, plagiarism, use of unauthorised electronic devices, for example) it will be considered that the student does not meet the requirements to pass the subject. In which case the overall mark for the academic year will be a fail (0.0). The use of any electronic device will not be permitted during the assessment tests unless expressly authorised. Bringing an unauthorised electronic device into the exam room will be considered grounds for failing the subject in the academic year and the overall mark will be a fail (0.0).

Sources of information

Basic Bibliography

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

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

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

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

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

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

Complementary Bibliography

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

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

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

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

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

Recommendations

Subjects that continue the syllabus

Modelling of biotechnological processes/V12G350V01924
Biotechnological processes and products/V12G350V01922

Subjects that are recommended to be taken simultaneously

Technical Office/V12G350V01604

Subjects that it is recommended to have taken before

Chemical engineering 1/V12G350V01405
Chemical engineering 2/V12G350V01503
Industrial chemistry/V12G350V01504

Other comments

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

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

IDENTIFYING DATA

Experimentación en química industrial II

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

Resultados de Formación e Aprendizaxe

Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C21	CE21 Capacidade para o deseño e xestión de procedementos de experimentación aplicada, especialmente para a determinación de propiedades termodinámicas e de transporte, e modelaxe de fenómenos e sistemas no ámbito da enxeñaría química, sistemas con fluxo de fluídos, transmisión de calor, operacións de transferencia de materia, cinética das reaccións químicas e reactores.
D2	CT2 Resolución de problemas.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia

Expected results from this subject	Training and Learning Results		
Profundizar no deseño e execución de experimentos de laboratorio e analizar os resultados obtidos e a extracción de conclusións.	B4	C21	D10
Coñecer os principios de operación dos principais equipos a escala de laboratorio na Química Industrial. Diagnosticar de forma empírica e simulada problemas de operación en equipos de proceso.	B3 B4	C21	D9
Establecer os parámetros da simulación de procesos químicos baseada en operación unitarias.			D6
Ampliar a habilidade na creación de fojas de cálculo propias y e programación mediante linguaxes de programación e simulacioón para o tratamento e interpretación dos datos experimentais.			D17

Reforzar a expresión oral e escrita para a transmisión de conceptos e resultados dun xeito ordeado e clarificador.	B3 B4	C21	D2 D6 D9

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

Planificación			
	Class hours	Hours outside the classroom	Total hours
Lección maxistral	7.5	15	22.5
Estudo de casos	12	18	30
Prácticas de laboratorio	24	36	60
Traballo tutelado	6	14	20
Resolución de problemas e/ou exercicios	0	14	14
Exame de preguntas obxectivas	0	3.5	3.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Metodoloxía docente	
	Description
Lección maxistral	Exposición na clase dos conceptos e procedimentos craves para a aprendizaxe dos contidos do temario
Estudo de casos	Actividade consistente na análise de situacións reais relacionadas coa experimentación na Enxeñería Química
Prácticas de laboratorio	Realización das experiencias de laboratorio que figuran nos contidos.
Traballo tutelado	Proxecto experimental realizado polo estudiante, de maneira individual ou en grupo, no cal poña en práctica os coñecementos adquiridos na materia

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

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

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

Other comments on the Evaluation

Criterios a seguir para a cualificación final

PRIMEIRA CONVOCATORIA

1. Estudantes que seguen a avaliación continua

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

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

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

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

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

2. Estudantes con renuncia oficial á avaliación continua

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

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

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

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

SEGUNDA CONVOCATORIA

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

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

Compromiso ético:

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

Bibliografía. Fontes de información

Basic Bibliography

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

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

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

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

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

Complementary Bibliography

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

Recomendacións

Subjects that continue the syllabus

Simulación e optimización de procesos químicos/V12G350V01702

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

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

Other comments

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

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

Resultados de Formación e Aprendizaxe	
Code	
B3	CG3 Coñecemento en materias básicas e tecnolóxicas que os capacite para a aprendizaxe de novos métodos e teorías, e os dote de versatilidade para adaptarse a novas situacións.
B4	CG4 Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e capacidade para comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial na mención de Química Industrial.
C22	CE22 Capacidade para deseñar, xestionar e operar procedementos de simulación, control e instrumentación de procesos químicos.
D2	CT2 Resolución de problemas.
D5	CT5 Xestión da información.
D6	CT6 Aplicación da informática no ámbito de estudo.
D9	CT9 Aplicar coñecementos.
D10	CT10 Aprendizaxe e traballo autónomos.
D17	CT17 Traballo en equipo.

Resultados previstos na materia			
Expected results from this subject	Training and Learning Results		
Elaborar procedementos de calibración e calcular incertezas de variables de proceso.	B3 B4	C22	D6 D9
Seleccionar a instrumentación máis adecuada nun proceso.	B3 B4	C22	D5 D9
Realizar a xestión integral da información de variables de proceso.	B3 B4	C22	D2 D5 D6 D9 D10
Deseñar sistemas de captura de variables de proceso e *interfaz de operador.	B3 B4	C22	D5 D6 D9 D10 D17
Simular o comportamento dinámico de equipos de proceso.	B3 B4	C22	D6 D9
Axustar *algoritmos de control de equipos e procesos *batch e continuos.	B3 B4	C22	D2 D6 D9

Contidos
Topic

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

Planificación

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

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

Metodoloxía docente

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

Atención personalizada

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

Avaliación

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

Other comments on the Evaluation

Alumnos con avaliación continua:-Na segunda convocatoria consérvase a nota da avaliación continua.&*nbsp;Alumnos con renuncia oficial á avaliación continua:-O exame final valerá o 100% da nota para aqueles alumnos con renuncia á avaliación continua concedidaoficialmente polo centro.Compromiso ético:Espérase que o alumno presente un comportamento ético adecuado. No caso de detectar un comportamento non ético (copia, plaxio, utilización de aparellos electrónicos non autorizados, e outros) considerarase que o alumno non reúne os requisitos necesarios para superar a materia. Neste caso a cualificación global no presente curso académico será de suspenso (0,0).

Bibliografía. Fontes de información

Basic Bibliography

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

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

Complementary Bibliography

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

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

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

Recomendacións

Subjects that are recommended to be taken simultaneously

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

Subjects that it is recommended to have taken before

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

Other comments

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

IDENTIFYING DATA				
Technical Office				
Subject	Technical Office			
Code	V12G350V01604			
Study programme	Grado en Ingeniería en Química Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Alonso Rodríguez, José Antonio Cerqueiro Pequeño, Jorge			
Lecturers	Alonso Rodríguez, José Antonio Cerqueiro Pequeño, Jorge López Saiz, Esteban Varela Alén, José Luis			
E-mail	jcerquei@uvigo.es jaalonso@uvigo.es			
Web	http://webs.uvigo.es/oficinatecnica			
General description	This matter has like vision and like mission approach to the student to his back professional life through the knowledge, handle and application of methodologies, technical and tools oriented to the preparation, organisation and management of projects and other technical documents. It employed a practical approach of the subjects, looking for the integration of the knowledges purchased to the long of the career of face to his application to the development of the methodology, organisation and management of technical works, as true essence of the profession of engineer in the frame of his *atribucións and fields of activity. *Promoverase The development of the competitions of the matter by means of a theoretical approximation-practical, in which the exposed contents of theoretical way develop by means of the realisation of practical activities and works of application oriented to the industrial reality of the profession, assimilating the agile and precise employment of the distinct rule of application and of the best practices established. Given the variety that produces in the spectrum of professional exits, the academic program possesses a part of general contents to all the Industrial Engineers, in which it treats to transmit those appearances that reinforce the **pluridisciplinaridad and possesses another more specific part of the speciality, that does reference to methodological or normative appearances of this field. Likewise the strategy employed allows to expose to the student the professional alternatives that open him , from the free professional exercise (**peritaciones, *ditames, reports, projects, etc.), even his immersion in a small / average technical office more oriented the installations or even to the design of product.			

Training and Learning Results	
Code	
B1	CG1 Skills for writing, signing and developing projects in the field of industrial engineering, whose purpose, specializing in Industrial Chemistry, construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of: structures, mechanical equipments, energy facilities, electrical systems and electronic installations and industrial plants, and manufacturing processes and automation.
B2	CG2 Ability to manage the activities object of the engineering projects described in CG1.
C18	CE18 Knowledge and skills to organize and manage projects. Know the organizational structure and functions of a project office.
D1	CT1 Analysis and synthesis.
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D7	CT7 Ability to organize and plan.
D8	CT8 Decision making.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D11	CT11 Ability to understand the meaning and application of the gender perspective in the different fields of knowledge and in professional practice with the aim of achieving a more just and equal society
D13	CT13 Ability to communicate orally and in writing in the Galician language.
D14	CT14 Creativity.
D15	CT15 Objectification, identification and organization.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

Expected results from this subject			
Expected results from this subject		Training and Learning Results	
(*)		C18	D3 D5 D6 D9 D10 D17
(*)	B1 B2	C18	D1 D2 D5 D6 D7 D8 D10 D11 D15 D17 D20
(*)	B1 B2		D1 D3 D5 D6 D7 D9 D14 D15 D17
(*)	B2	C18	D1 D2 D3 D5 D6 D7 D8 D9 D11 D13 D14 D16 D17 D20
(*)			D3 D5 D6 D7 D13 D14 D17 D20

Contents	
Topic	
Presentation	Presentation Guides Educational Methodology of work. Groups of work *Fontes of information and communication: SUBJECT and other Knowledges and *aplicacions computer for the matter.
Technical office.	Introduction *Funcions. Organisation of the work. Technicians of Work in instruments. Integration with the systems of the company. *Kanban. Taking of decision by means of weighting of criteria. Communication.

Cycle of life of a project	Phase I. Start. Diagram of functional blocks and the *sua description. Global definition of the project. Legal feasibility. (*PGOM And environmental legislation) Phase II. Scope and aims. Phase III. Realisation of the project. Phase IV. Closing: permissions and certifications of the project
Industrial project.	Project: Concept, classification, structure, cycle of life. Documents of the project: Index, memory, planes. *pliegos Of conditions, budget, studies with own entity. Normalisation. It JOINS 157002.
Administrative management of works of engineering.	Processing: visa, notary, Public Organisms, etc. Management of licences, permissions and permissions in front of public and personal institutions. Bidding and contracting of projects.
Industrial project. Planes	Structure and index of the planes. Typology of representation: dimension and relation. Block of titles. Sizes and scales. Folded. Criteria for wool preparation of planes. Example; planes of distribution. Example: planes of installations. Diagrams of principle. Legend of symbology.
Fire protection	Basic concepts: classification, sectorization, classification of materials, NRI, evacuation, means of protection. RD 2267/2004 and CTE DB-SI.
Budget and planning.	Measurement economic assessment Theory of management and planning of projects. Agile methodologies, *Gantt, *CPM and *PERT
Basic elements of construction	Basic elements of construction. Cover. *Cimentación. Structural elements. Coatings. Carpentries. Finishings. Examples.
Methodology of design of installations	Types of installations. Determination of loads. Elements of feeding of the loads. Elements of performance control and security. Planes of installations and diagrams of principle.
I fold of Conditions.	Types. Administrative Technical *Facultativas Bidding and contracting of projects.
Legislation.	Legislative legislation Interpretation of the technical legislation generic technical Legislation applied the speciality: *RD 485/1997, *RD 486/1997, *PGOM, *RD 314/2006
Technical documents.	Report: Concept, classification, structure. Certifications . Homologation *Peritaciones, Valuations.
Studies with own entity.	Relative studies to the fulfillment of the legislation of labour risks: Basic Study of Security and Health. Relative studies to the fulfillment of the legislation of management of waste.
Professional activity.	Processing: visa, notary, Public Organisms, etc. Management of licences, permissions and permissions in front of public and personal institutions. Bidding and contracting of projects.
Patent rights.	Technological innovation and patent rights. Patents and models of utility.
(*)Comunicación	(*)Técnicas de presentación de trabajos orales y escritas

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	2	0	2
Lecturing	12	24	36
Mentored work	2	6	8
Project based learning	12	24	36
Problem solving	6	6	12
Practices through ICT	4	4	8
Design Thinking	2	8	10
Learning-Service	4	20	24
Scientific events	2	8	10
Presentation	1	3	4

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

Methodologies	
	Description
Introductory activities	The subject will be presented, information on the contents of the same, methodologies to be applied, work to be done in the subject and form of evaluation. Likewise, dynamics will be carried out in the class to promote the interrelationship in the students.
Lecturing	Presentation by the teacher of the contents on the subject of study, theoretical bases and/or guidelines of a work, exercise or project to be developed by the student.
Mentored work	Prepare a technical report on any issue related to Industrial Engineering, with the quality and rigour expected of an Industrial Engineer.
Project based learning	Work will be done using the methodology of "Project-Based Learning- *ABP". Realization of an engineering project, working with an open team. Emphasis will be placed on applying industrial engineering tools and knowledge to create engineering solutions for the real needs of an industry. Submit Problem solving The student must develop the right or correct solutions the exercises posed that are based on the theory taught. They will be performed by applying formulas, algorithms or transformation procedures gives available information. Interpretation of the results will be necessary.
Problem solving	The student must develop the right or correct solutions the exercises raised that are based on the theory taught. They will be performed by applying formulas, algorithms or transformation procedures gives available information. Interpretation of the results will be necessary.
Practices through ICT	Knowledge application activities in a given context, and the acquisition of basic and procedural skills in relation to the subject, through ICT.
Design Thinking	An interdisciplinary group will be created with students from other subjects and grades. This group, applying the methodology "Design Thinking" will generate a work of implementation and / or improvement on a specific activity.
Learning-Service	Learning-Service (ApS) is an innovative methodology that tries to change reality and improve students' learning. It is inserted into the set of activities carried out by a student, and connects with innovative proposals such as competency-based education, project-based or problem-based learning, cooperative and collaborative learning.
Scientific events	To present the ideas developed by students in collaborative groups, a presentation is organized in congress format. This will be public and broadcast in different media.

Personalized assistance	
Methodologies	**Description**
Project based learning	The student will complete an engineering project, working with an open team. Emphasis will be placed on the application of industrial engineering tools and knowledge to create engineering solutions for the real needs of an industry. Group tutorials will be held with the teacher to answer questions and to follow up on the work.
Mentored work	The student, individually, prepares a technical report, or similar document, on a topic proposed by the teacher. Tutorials will be individual. The student's doubts will be clarified and he/she will be helped in the organization and planning of the work. Tutorials can be done in small groups, bringing together students with the same problem, for a better efficiency.
Design Thinking	The students, in a multidisciplinary group with students from other degrees, will work on a solution to the problem posed. This will be done by applying the Design Thinking methodology and simultaneously applying the Learning as a Service methodology. Meetings are planned to explain the methodologies to be applied and group tutorials to monitor the work.
Scientific events	We will work with the different groups of students to help them prepare the public exhibition of their work. You will conduct several rehearsals with them and guide them to achieve an effective presentation
Learning-Service	This methodology is integrated with the Design Thinling, so the monitoring will be as indicated in that section.

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	Theory: The proofs will be of type test or of brief answer. Minimum note of this part: 5 on a qualification of 10 (in this part)	15	B1 B2	D2 D9

Mentored work	Elaborate a relative technical report the any question related with the Industrial Engineering, with the quality and the rigour that expects of an Industrial Engineer. It published a *rúbrica of evaluation in the platform *MOOVI of the subject.	15	B1	D1 D3 D5 D6 D7 D8 D9 D10 D15 D16
Project based learning	Realisation of a project of engineering, working with an open team. It will do upsetting in the application of tools and knowledges of industrial engineering to create solutions of engineering for the real needs of an industry. It published a *rúbrica of evaluation in the platform *MOOVI of the subject. The evaluation includes an individual proof on the work and *ponderara the note of the project as it will expose in the *rubrica of evaluation.	40	B1 C18 B2	D2 D3 D5 D7 D8 D9 D10 D14 D17 D20
Learning-Service	Realisation of a work in group *interdisciplinar, with students of other subjects and degrees. This group, applying the methodology "*design *thinking" will do a work of implantation and/or improvement on a concrete activity. It will publish a *rúbrica of evaluation in the platform *MOOVI of the subject. In the *rúbrica collects the analysis of ethical and social appearance.	15		
Scientific events	Presentation of the ideas developed by the students in the groups *colaborativos. This activity will be public and with diffusion in different media. It published a *rúbrica of evaluation in the platform *MOOVI of the subject.	5		D1 D3 D5 D6 D17 D20
Presentation	Presentation of group of class of the work made with the methodology of Learning-Service. It valued the preparation of the presentation in *PowerPoint or equivalent and the oral exhibition of the same, to 50% each item.	10		

Other comments on the Evaluation

SYSTEM OF EVALUATION:----------

The system of evaluation by defect is the system of continuous evaluation. The student that wish to received to the system of evaluation no continuous will owe to requested officially, in the term and way established by the administration of the And.And.I. Yes the student does not request devandita renounces or does not obtain the favourable verdict of the renounces the continuous evaluation, understands which this in the system of continuous evaluation.

The evaluation will realize in base them rúbricas that publish in the platform MOOVI of the subject.

CRITERIA FOR CONTINUOUS

EVALUATION: ==========

To surpass the subject by means of the evaluation continued owe to fulfil, simultaneously, two conditions:

it) obtain a minimum punctuation of 5 on 10 in each of the apartados avaliables or parts indicated in the rúbricas that publish .

b) Obtain a half note, pondered second the percentages indicated previously, minimum of 5 on 10.

Yes one ítem this suspenso, or the student wishes to improve the note of one ítem, will have a maximum of two (2) opportunities to do it. In this case it will apply , envelope to qualification of the apartado, a coefficient corrector that indicated in the presentation of the course. The term for devanditas corrections will be established pole teaching staff.

The percentage that supposes each of the ítems in the qualification of the subject is the indicated in the following table.Ítems PercentageExamination of theoretical contents 15%technical Report 15%Project of activity 40%Work colaborativo. Learning-service 15%Communication of results (PowerPoint or analog) 5%Communication of results (presentation in examination) 5%Communication of results (presentation in congress) 5%Examination of project Factor multiplicador of the projectMaquetación of the final document demeritoEditorial of the final document demeritoFulfilment of norms of delivery and terms demerito

The subject evaluates in base it one rubrica of evaluation. In the platform MOOVI, published rubrícaa of evaluation of each of the apartados of the subject.

The terms and formats of delivery of the activities published in the platform MOOVI of the subject.The activities indicated

like demerito, qualify splitting of a note of 10 and yes no fulfil the specifications indicated in rubrícalas, suppose a factor of multiplication between 0 and 1, that multiplied the global note obtained.
The subject evaluates in base it one rubrica of evaluation. In the platform MOOVI, published rubrícaa of evaluation of each of the apartados of the subject.The terms and formats of delivery of the activities published in the platform MOOVI of the subject.

CRITERIA OF OVERRUN OF The MATERIAMEDIANTE GLOBAL EVALUATION:
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The students that opt for requesting the global evaluation realized an examination with the following structure:
1. Part of theory. Length 45 minutes. Can be used notes and notes of kind, only in bear paper.
Rest of 20 minutes.
2. Practical exercise of realization of one project technical. 150 minutes. Can be used computer Rest of 20 minutes
3. Manufacture of a presentation in PowerPoint or similar, envelope the project developed in the apartado previous. 30 minutes. Use of the computer.
Rest of 10 minutes.
4. Oral exhibition of the previous presentation. Limited it a minimum of 5 minutes and a maximum of 10 minutes. Use of computer and proxector.
5. Relative oral questions to the presentation and the exercise of project during a maximum of 15 minutes.
The computer can be what bring the student, or facilitated the use of one of the computers of the classrooms computings of the School.
The presentation and oral defence will be recorded in video, in accordance with the rule gave University. The percentage that supposes each of the ítems in the qualification of the subject is the indicated in the following table.

Ítems	Percentage
Examination of theoretical contents	30%
Project of activity	40%
Communication of results (PowerPoint or analog)	10%
Communication of results (presentation in examination)	10%
Communication of results. Oral answers to questions	10%

ETHICAL COMMITMENT:
==========
it Expects that the present student an ethical behaviour accommodated. When studying the subject, the student, purchases a commitment of work in team, collaboration and as regards the mates and to the teaching staff. In the case to detect a no ethical behaviour (copy, plaxio, utilization of unlicensed electronic devices and others) will consider that the student does not gather the necessary requirements to surpass the subject. In this case the global qualification in the present academic course will be of suspenso (0.0).

Sources of information

Basic Bibliography

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MARTÍNEZ GABARRÓN, ANTONIO, **Análisis y desarrollo de proyectos en la ingeniería alimentaria**, ECU, 2011

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MEYERS FRED E., STEPEHENS MATHEW P., **Diseño de instalaciones de manufactura y manejo de materiales, Diseño de instalaciones de manufactura y manejo de materiales**, Prentice Hall, 2006

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

Recommendations

Subjects that continue the syllabus

Final Year Dissertation/V12G360V01991

Subjects that it is recommended to have taken before

Graphic expression: Fundamentals of engineering graphics/V12G360V01101