



IDENTIFYING DATA

Industrial chemistry

Subject	Industrial chemistry			
Code	V11G200V01904			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language				
Department				
Coordinator	Deive Herva, Francisco Javier Gago Martínez, Ana			
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General description	<p>Chemical industry represents one of the most booming sectors in the economy of many countries, being the basis for many other industries like metallurgic, petrochemical, food and electronic ones. Similarly, recent advances on high efficient materials, electronic devices, medical applications, together with new environmental and agricultural technologies are fostered by continuous improvements and innovations in each stage of the process design.</p> <p>Therefore, this subject is devoted to provide the student with a comprehensive approach of Industrial Chemistry, going from the construction and understanding of process flowsheets diagrams of chemical processes with socio-economic interest, to the performance of quality principles underlying them.</p>			

Competencies

Code	
A16	(*)Demostrar coñecemento e comprensión de feitos esenciais, conceptos, principios e teorías en: principios e procedementos en Enxeñaría Química
A19	(*)Aplicar os coñecementos e a comprensión á resolución de problemas cuantitativos e cualitativos de natureza básica
A20	(*)Avaliar, interpretar e sintetizar datos e información química
A22	(*)Procesar datos e realizar cálculo computacional relativo a información e datos químicos
A23	(*)Presentar material e argumentos científicos de xeito oral e escrita a unha audiencia especializada
B1	(*)Comunicarse de forma oral e escrita en polo menos unha das linguas oficiais da Universidade
B3	(*)Aprender de forma autónoma
B4	(*)Procurar e administrar información procedente de distintas fontes
B5	(*)Utilizar as tecnoloxías da información e das comunicacións e manexar ferramentas informáticas básicas
B6	(*)Manexar as matemáticas, incluíndo aspectos tales como análise de erros, estimacións de ordes de magnitude, uso correcto de unidades e modos de presentación de datos
B7	(*)Aplicar os coñecementos teóricos á práctica
B8	(*)Traballar en equipo
B9	(*)Traballar de forma autónoma
B10	(*) Traballar nun contexto tanto nacional como internacional
B12	(*)Planificar e administrar adecuadamente o tempo
B13	(*)Tomar decisións
B14	(*) Analizar e sintetizar información e obter conclusións
B15	(*)Avaliar de modo crítico e construtivo o entorno e a si mesmo

Learning aims

Expected results from this subject	Training and Learning Results
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(*)To know the main processes for raw materials conversion in order to obtain products and valorize them	A16	B1
	A19	B3
	A20	B4
	A22	B5
	A23	B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*) To know different techniques to minimize the generation of by-products and wastes	A16	B1
	A19	B3
		B4
		B5
		B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*)To acquire habilities on process flowsheet diagrams interpretation and design on the basis of real processes.	A16	B1
	A20	B3
	A23	B4
		B5
		B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*) To identify generic systems for quality management in laboratories and to know the required essential documentation	A16	B1
	A19	B3
	A20	B4
	A23	B5
		B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*)To establish analytical methodology suitable for warranting the quality of raw materials and products, as well as the pollution derived from the industrial process.	A16	B1
	A19	B3
	A20	B4
	A22	B5
	A23	B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15

(*)To integrate automatized and miniaturized systems on the control of industrial processes.	A16	B1
	A19	B3
	A22	B4
	A23	B5
		B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*)To evaluate the best available techniques for a desired industrial process of the galician socioeconomic environment.	A16	B1
	A19	B3
	A20	B4
		B5
		B7
		B8
		B9
		B10
		B12
		B14
		B15
(*)To acquire the ability of designing a process for the production of biofuels or biocatalysts at laboratory scale, on the basis of the process flowsheet diagrams.	A16	B1
	A19	B3
	A20	B4
	A22	B5
	A23	B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
To understand the role of bioengineering as an environmentally sustainable alternative to obtain products with commercial interest	A16	B1
	A19	B3
	A20	B4
		B5
		B6
		B7
		B8
		B9
		B10
		B12
		B13
		B14
		B15
(*)To evaluate the economic viability of industrial processes by using basic tools such as the Net Present Value, the Internal Rate of Return of the Return of Investment	A20	B1
	A22	B3
	A23	B4
		B5
		B6
		B7
		B8
		B14
		B15

Contents

Topic	
Subject 1. Introduction to processes in Industrial Chemistry	General aspects of chemical processes. Characteristics and sectorial structure of chemical industry. Facts and figures of spanish and european chemical industry. Process flowsheet diagrams
Subject 2.- Economy of industrial processes.	Preparation of budget. Analysis of costs and profits. Criteria of economic feasibility: Net Current Value, Internal Tax of Performance, Time of return.

Subject 3.- Biotechnological Processes.	Fundamental stages of biotechnological processes. Pretreatment of raw materials. Types of bioreactors. Product recovery and downstream strategies. Processes for the production of biofuels. Food biotechnology
Subject 4.- Introduction to the petrochemical industry.	Oil reserves, types and composition. Crude refining. Types of refineries: basic structure.
Subject 5.- Petrochemistry.	General flowsheet of a petrochemical refinery. Crude fractionation. Thermal cracking: coking unit. Catalytic cracking, reactors, etc. Catalytic reforming. Desulfurization.
Subject 6.- Petrochemicals.	Production, characterisation and application of products obtained from a petrochemical refinery.
Subject 7.- Carbon chemistry	Coal reserves, types and composition. Production of metallurgical coke. Valorisation of coke by-products. Carbon refinery.
Subject 8.- The cement industry.	Raw materials and dosage. Manufacture of clinker. Control of emissions. The energy in the cement sector. Valorisation of wastes. Evaluation of the best available techniques.
Subject 9.- The paper industry.	Methods for pulp mill manufacturing: Kraft process, sulfide process. Paste bleaching. Paper manufacturing. Environmental concerns of gas and liquid emissions. Paper recycling. Analysis of the best available technicians.
Subject 10.- The industry of Aluminium.	Natural sources. Production of alumina. Process for aluminium manufacturing.
Subject 11.- Basic elements and principles of quality.	Introduction to the control of quality. Implementation of systems of quality. Tools of quality. International Standards - ISO. Quality manual. Control of Processes quality (prime Matters, transformation and final product)

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	26	52	78
Troubleshooting and / or exercises	5	13	18
Tutored works	5	10	15
Presentations / exhibitions	3	6	9
Outdoor study / field practices	3	6	9
Short answer tests	1	4	5
Long answer tests and development	2	14	16

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

Methodologies

	Description
Master Session	Presentation of the general aspects of the program, focusing on the fundamental aspects with more difficulties to be understood by the students. The lecturer will give the basic material by Tema platform in order to get the students familiarized with the topic prior to the presentation in class.
Troubleshooting and / or exercises	After each subject, the most relevant aspects will be tackled by means of problem and questions solving.
Tutored works	The students will carry out a work focused on the design of a process for producing some product with industrial interest, taking into account the knowledge acquired during the master sessions.
Presentations / exhibitions	The students have to defend their tutored works in front of a jury made up of lecturers from the departments of Chemical Engineering or Analytical Chemistry and/or professionals from chemical industries
Outdoor study / field practices	Different outdoor studies will be carried out throughout the course, in order to get a deeper insight into the processes explained during the master sessions. Priority will be given to top companies of our socioeconomic environment.

Personalized attention

Methodologies	Description
Master Session	During tutoring hours, the students can ask the lecturers about any aspect of the subject. In the same way, students can communicate with the teachers via E-mail or Tema platform. The lecturers will show their availability for tutoring on the first day.
Troubleshooting and / or exercises	During tutoring hours, the students can ask the lecturers about any aspect of the subject. In the same way, students can communicate with the teachers via E-mail or Tema platform. The lecturers will show their availability for tutoring on the first day.
Tutored works	During tutoring hours, the students can ask the lecturers about any aspect of the subject. In the same way, students can communicate with the teachers via E-mail or Tema platform. The lecturers will show their availability for tutoring on the first day.

Presentations / exhibitions	During tutoring hours, the students can ask the lecturers about any aspect of the subject. In the same way, students can communicate with the teachers via E-mail or Tema platform. The lecturers will show their availability for tutoring on the first day.
Outdoor study / field practices	During tutoring hours, the students can ask the lecturers about any aspect of the subject. In the same way, students can communicate with the teachers via E-mail or Tema platform. The lecturers will show their availability for tutoring on the first day.

Assessment		
	Description	Qualification
Troubleshooting and / or exercises	Different troubleshooting will be solved by the students at the framework of their tutored works	10
Tutored works	A work focused on the design of an industrially relevant process flowsheet diagram will be carried out during the term.	10
Presentations / exhibitions	The tutored works will be defended against a jury composed of lecturers from the Departments of Chemical Engineering and Analytical Chemistry and/or professionals from the chemical industry.	15
Outdoor study / field practices	The students must unavoidably attend the outdoor studies in order to get a deeper insight into the processes tackled during the master sessions. A report about questions on the plants will be done by them after each visit.	10
Short answer tests	Short tests will be performed in the middle and at the end of the course. Students will be encouraged to relate new ideas with their own views, and to solve problems based on the new knowledge acquired	10
Long answer tests and development	A final long answer test will be done at the end of the course, and the students will have to have a minimum of 5 out of 10 to pass the course.	45

Other comments on the Evaluation

Sources of information

Atkins, J.W. [Making pulp and paper], (Recurso electrónico) Tappi Press (USA) 2004.

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Casey, J.P. [Pulpa y papel: química y tecnología química], Ed. Noriega, 1991.

Díaz, M. [Ingeniería de bioprocesos], Ed. Paraninfo, 2012.

Duda W.H. [Manual tecnológico del cemento], Ed. Reverté, 1995.

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

Gani, M.S.J. [Cement and concrete], Ed. Chapman & Hall, 1997.

Gary, J.H. [Refino de petróleo: tecnología y economía], Ed. Reverté, 1980.

Happel, J. [Economía de los procesos químicos], Ed. Reverté, 1981.

Herranz Agustín, C. [Química para la ingeniería], Ed. UPC, 2010.

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

Rodríguez Jiménez, J. [Los controles en la fabricación de papel], Ed. Blume, 1970.

Shuler, M.L. [Bioprocess engineering: basic concepts], Prentice Hall, 2002.

Vian Ortuño, A. [Introducción a la Química Industrial], Ed. Reverté, 1996. Quimiometría de Guillermo Ramis Ramos, M^a Celia Gracia Álvarez-Coque. Editorial Síntesis S. A., 2001, Madrid, España.

Quality in Chemical Measurements, Training Concepts and Teaching Materials. Wolfhard Wegscheider Chemie, Springer Verlag, 2001, Germany.

ISO 9000 Quality Systems Handbook, David Hoyle, 6^a Edición, 2009, Elsevier, Amsterdam.

Recommendations

Subjects that it is recommended to have taken before

Chemical engineering/V11G200V01502