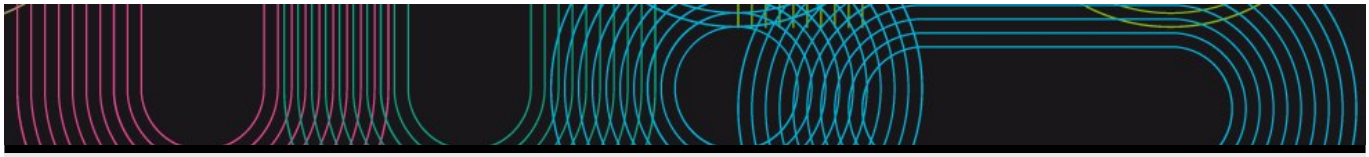

IDENTIFYING DATA				
Industrial chemistry				
Subject	Industrial chemistry			
Code	V11G200V01904			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Rodríguez Rodríguez, Ana María			
Lecturers	Deive Herva, Francisco Javier Gago Martínez, Ana Rodríguez Rodríguez, Ana María			
E-mail	aroguez@uvigo.es			
Web				
General description	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. 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.			

Competencies	
Code	
C16	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: principles and procedures in chemical engineering
C19	Apply knowledge and understanding to solve basic problems of quantitative and qualitative nature
C20	Evaluate, interpret and synthesize data and chemical information
C22	Process and perform computational calculations with chemical information and chemical data
C23	Present oral and written scientific material and scientific arguments to a specialized audience
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D4	Search and manage information from different sources
D5	Use information and communication technologies and manage basic computer tools
D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations
D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D10	Work at a national and international context
D12	Plan and manage time properly
D13	Make decisions
D14	Analyze and synthesize information and draw conclusions
D15	Evaluate critically and constructively the environment and oneself

Learning outcomes	
Expected results from this subject	Training and Learning Results

(*) To know different techniques to minimize the generation of by-products and wastes	C16 C19	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
(*)To acquire habilities on process flowsheet diagrams interpretation and design on the basis of real processes.	C16 C20 C23	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
(*) To identify generic systems for quality management in laboratories and to know the required essential doccumentation	C16 C19 C20 C23	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
(*)To establish analytical methodology suitable for warranting the quality of raw materials and products, as well as the pollution derived from the industrial process.	C16 C19 C20 C22 C23	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
(*)To integrate automatized and miniaturized systems on the control of industrial processes.	C16 C19 C22 C23	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15

(*)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.	C16 C19 C20 C22 C23	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
To understand the role of bioengineering as an environmentally sustainable alternative to obtain products with commercial interest	C16 C19 C20	D1 D3 D4 D5 D6 D7 D8 D9 D10 D12 D13 D14 D15
(*)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	C20 C22 C23	D1 D3 D4 D5 D6 D7 D8 D14 D15
New	C16 C19 C20	D4 D5 D7 D8 D9
New	C16 C20	D4 D8 D9 D10 D12 D13

Contents	
Topic	
Subject 1. Introduction to processes in Industrial Chemistry	General aspects of chemical processes. Characteristics and sectorial sctructure 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.- Biotecnological 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 5.- Petrochemistry.	Oil reserves, types and composition. Crude refining. Types of refineries: basic structure. General flowsheet of a petrochemical refinery. Crude fractionation. Thermal cracking: coking unit. Catalytic cracking, reactors, etc. Catalytic reforming. Desulfurization.
Subject 4.- Biofuels	Energy concerns and current regulations. Raw materials. Processes for the production of biofuels. Alternatives for conventional processes
Subject 7.- 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 te 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	Training and Learning Results	
Troubleshooting and / or exercises	Different troubleshooting will be solved by the students at the framework of their tutored works	10	C16 C19 C22	D3 D5 D6 D7 D9 D14

Tutored works	A work focused on the design of an industrially relevant process flowsheet diagram will be carried out during the term.	20	C16 C20 C22 C23	D1 D4 D5 D6 D7 D8 D10 D12 D13 D14 D15
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.	10	C16 C23	D1 D5 D8 D12 D13 D14
Outdoor study / field practices	The students must unavoidably attend the outdoor studies in order to get a deper insight into the processes tackled during the master sessions. A report about questions on the plants will be doned by them after each visit.	5	C20 C22	D7 D8 D14 D15
Short answer tests	Short tests will be performed in the middel 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	C16 C19 C20 C22 C23	D3 D7 D9 D12 D13 D14
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	C16 C19 C20 C22 C23	D3 D7 D12 D13 D14

Other comments on the Evaluation

In order to pass the subject, at least 5 points out of 10 should be achived in each of the evaluted activities. It is expected that the students show an ethical behaviour concerning plagiarism, use of unauthorized electronic devices or suitable team work. Otherwise, the student will be rated with 0 (fail).

Evaluation in July
The activities that have been obtained a mark higher than 5 will be maintaned.

Sources of information

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

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

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

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

J. Happel, **Economía de los procesos químicos**, Reverté,

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

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

G. Ramis Ramos et al., **Quimiometría**, Sintesis,

W. Wegscheider, **Quality in Chemical Measurements, Training Concepts and Teaching Materials**, Springer,

D. Hoyle, **ISO 9000 Quality Systems Handbook**, Elsevier,

J.M. de Juana, **Energias renovables para el desarrollo**, Thompson,

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

Austin, G.T. "Manual de Procesos Químicos en la Industria", Ed. McGraw Hill, 1993.
Casey, J.P. "Pulpa y papel: química y tecnología química", Ed. Noriega, 1991.
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Duda W.H. "Manual tecnológico del cemento", Ed. Reverté, 1995.
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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, Mª Celia Gracía Álvarez-Coque. Editorial Sintesis 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, 6ª Edición, 2009, Elsevier, Amsterdam.

Recommendations

Subjects that it is recommended to have taken before

Chemical engineering/V11G200V01502
Project/V11G200V01701