COURSE DATA

Data Subject	
Code	34773
Name	Process and Product Engineering II
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	4	First term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	17 - Process and product engineering	Obligatory

Coordination

Name	Department
SANCHEZ TOVAR, RITA	245 - Chemical Engineering
SOLSONA ESPRIU, BENJAMIN EDUARDO	245 - Chemical Engineering

SUMMARY

Process and Product Engineering II is a four-monthly compulsory module to be taught in the fourth year of the Degree in Chemical Engineering, with a charge of 6 ECTS. This module is part of a subject (Process and Product Engineering - IPP) having an overall charge of 10.5 ECTS, 4.5 of them for the first part to be conducted in the third year of the degree (PPI-I).

It is a core subject in the curriculum of Chemical Engineering due to the great importance that the knowledge of industrial chemical processes has. It will be focused on the description and analysis of these processes with special emphasis on aspects related to the choice and use of raw materials, energy saving and environment. Fundamental aspects of Product engineering will also be studied.

Students who pass this course must learn, in a basic way, the characteristics of the major industrial chemical processes and evaluate, in the context of technological development, the importance of the concept “product”. Students should also be able to interpret drawings and flowcharts, to propose different alternatives and select the most appropriate for a particular product.

The theory classes will be taught in Spanish and practical and laboratory classes according to the technical file available on the web of the degree.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The student who enrols in this course should have knowledge of physics, chemistry and chemical engineering (unit operations and chemical reactors). They must also have an intermediate level of English reading.

OUTCOMES

1401 - Degree in Chemical Engineering

- G1 - Ability to write, sign and develop industrial engineering projects in the field of chemical engineering, according to the aquired knowledge through the specific technology in Industrial Chemistry, aimed at the construction, refurbishment, repair, conservation, demolition, manufacture, installation, assembly and operation of structures, mechanical equipment, energy facilities, electrical and electronic installations, industrial installations and plants, and manufacturing and automation processes.
- G2 - Ability to manage the activities involved in the engineering projects described in the previous heading.
- G4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering.
- G5 - Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and analogous work.
- G6 - Ability to deal with specifications, regulations and mandatory standards.
- G7 - Ability to analyse and assess the social and environmental impact of technical solutions.
- G10 - Ability to work in a multilingual and multidisciplinary environment.
- G11 - Knowledge, understanding and ability to apply the necessary legislation for practising professionally as a qualified industrial technical engineer.
- TE1 - Knowledge of material and energy balances, biotechnology, matter transfer, separation operations, chemical reaction engineering, reactor design, and valorisation and transformation of raw materials and energy resources.

LEARNING OUTCOMES

The student should be able to:

• Understand the basic principles of engineering processes and products (TE1).

• Design components, products and services in accordance with standards and specifications (G1, G2, G7, G11).

• Analyze processes, equipment and facilities, assess their adequacy and propose alternatives (G1, G5, G7).

• Work in teams (G4, G10).

• Manage information and use of Information Technology and Communications (G5, G10).

• Organize and plan (G2, G4, G10).

• Possess critical thinking skills, creativity and decision-making (G4).

• Gather and interpret information and make judgments on social, scientific, technological or ethical issues (G6, G7, G11).

• Continue his/her learning and update his/her training throughout working life with a high extent of autonomy (G4, G10).

Skills to acquire

The student should be able to:

• Identify the main raw materials used in the chemical industry.

• Know the main sources of energy used in the chemical industry.

• Know the energy problem in the context of the chemical industry.

• Know how the industrial gases are obtained and their main applications.

• Describe the processes of separation of the air components and their main applications.

• Identify the main applications of NaCl in the Chemical Industry.

• Describe the process for obtaining sodium carbonate (Solvay process).

• Describe the electrolysis of NaCl in aqueous solution.

• Know the lime manufacturing process and its applications.

• List the different types of cement and their properties and applications.

• Knowing the method of manufacture of Portland cement.

• Know the main features and characteristics of the glass.

• Describe the process of glass making.

• Know the characteristics and properties of ceramic products

• Know the process for manufacturing ceramic wall and floor tiles.

• Know the processes of production and applications of SO2.

• Describe the process of sulfuric acid manufacture.

• List the main applications of phosphate rock as raw material.

• Knowing the overall scheme of the operation of a refinery.

• List and identify the main oil refining operations and its implications in the development of fuels and raw materials for the petrochemical industry.

• Identify applications of C2-C4 olefins.

• Identify the applications of BTX fraction.

• Explain the collection and uses of synthesis gas.

• Know the process for making ammonia.

• Define the concept of fertilizer.

• Understand the main methods for the production of fertilizers.

• Sort the major classes of polymers according to their properties and applications.

• Know the process for manufacture of pulp and industrial use.

• Know the main components used in the formulation of varnishes and paints.

• Know the process for manufacture for varnishes and paints.

• Know the industrial applications for oils and fats.

• Describe the process for obtaining fatty acids and soaps.

• Know the rules of health and safety in the chemical industry.

• Define the concept of Product.

• Identify potential market opportunities.

• Set the different stages in the product design cycle.

• Know the different validation trials and product approval.

DESCRIPTION OF CONTENTS

1. Introduction to the study of industrial chemical processes.

Basic knowledges about the chemical industry. Raw materials. Energy in the industry.

2. Inorganic Chemical Industry

Industrial gases.
Chemicals derived from sodium chloride.
Limestone as a feedstock. The cement industry
Silica as a raw material. Glassmaking process.
Silicates as a feedstock. Ceramic Industry.
Sulphur as a raw material. Sulphuric acid production.
Phosphate rock as a feedstock. Process to obtain phosphoric acid. Fertilizers.

3. Petroleum and Petrochemical

The petroleum refining industry.
Current status and prospects of oil. Composition and properties of oil. Atmospheric and vacuum distillation. Thermal and catalytic cracking. Catalytic reforming. Alkylation. Isomerization. Hydrotreating and hydro-cracking. The petrochemical industry.
Petrochemical Industry. Production and functionalization of olefins and aromatics. Obtaining and uses of the synthesis gas.

4. Chemical Industry of performance products

Polymers.
Industrial use of cellulose.
Varnishes and paints.
Soaps and detergents.

5. Product Engineering

Product engineering. Design and manufacture of the product.
Design cycle of a product. Manufacturing process of a product.
Product engineering. Product validation and industrialization
Validation tests and product approval. Industrialization of a product.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	35,00	100
Classroom practices	25,00	100
Development of individual work	20,00	0
Study and independent work	25,00	0
Preparation of evaluation activities	45,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is organized around three axes: theoretical lectures, practical classes and tutorials.

Lectures:

The method of the lectures will be based primarily on lecture model. The teacher will show the contents of each topic, highlighting the key aspects (G1, G2, G5, G6, G7, G11, TE1).

Practical classes:

At the beginning of the course, a work will be proposed to the students. Specifically, each working group (made up of 2-3 students) will have to write a detailed report on an industrial process. Finally, the students will have to make an oral presentation with a further discussion with the lecturers and other students (G1, G2, G4, G5, G6, G7, G10, G11, TE1).

Tutorials:

Regarding the tutorials, students will attend in groups. This tutorials have as an aim to clarify the aspects which remain unclear for the student (G1, G2, G4, G5, G6, G7, G11, TE1).

EVALUATION

First Call

Assessment of student learning will take place following two models:

1) Mode A, which will consider the marks obtained in two individual exams.

The evaluation by the mode A) will be held considering two separate blocks: Block I: Issues 1 to 2, Block II: subjects 3 to 5.

The exam of the Block I will be done when the content of this block is finalized, whereas the exam corresponding to the Block II will be conducted on the official date of the first call.

To qualify for Mode A) the average score of the 2 individual exams must be equal to or greater than 5. Additionally, the marks in each of the individual tests will have to be equal to or greater than 4. The final mark for this mode A) will be calculated according to the following criteria:

37.5% Mark of the first test

37.5% Mark of the second test

25% Mark of planned activities

In order to pass the module with this mode the students will have to achieve a final mark equal to or greater than 5. Any student who does not obtain a mark of 4 or higher in the first individual exam will have the chance of passing the module in the first call through the mode B).

2) In mode B) the student will have to do a final exam of the two blocks on the date of the first call. The Final mark for this mode B) will be calculated according to the following criteria:

75% Mark of the Final Exam.

25% Mark of planned activities.

In order to pass the module according to the mode B), the students must obtain in the Final exam a mark greater than or equal to 5 and the Final mark must also be equal or greater than 5.

Second Call

Students who have not passed the module in the first call will have a second opportunity in the second call. In the second call the students will be evaluated, in all cases, through mode B).

(G1, G2, G4, G5, G6, G7, G10, G11, TE1)

Anyhow, the evaluation system will be based on the guides stated in the “Reglament d’Avaluació i Qualificació de la Universitat de València per a Graus i Màsters” (https://goo.gl/UdDYS2).

REFERENCES

Basic

- Introducción a la química industrial (2a. ed.), Vian Ortuño, Ángel. España: Editorial Reverté, 2012. ProQuest ebrary. Web. (libro electrónico).
- Manual de Procesos Químicos en la Industria, Austin, G.T., G.T., Ed. MacGraw-Hill, 1992, traducción de Shreves Chemical Process Industries (5ª Edición), Ed. MacGraw-Hill, 1984.
- Riegel's Handbook of Industrial Chemistry (8ª Edición), Kent, J.A., Ed. Van Nostrand Reinhold Company, 1983.
- Handbook of Chemical Production Processes, Meyers, R.A., Ed. MacGraw-Hill, 1986.
- Survey of Industrial Chemistry, Chenier, P.J., Ed. Wiley Interscience, 1986.
- Refino de Petróleo, Gary, J.H. y Handwerk, G.E., Ed. Reverté, 1980.
- Petróleo y gas natural: industria, mercados y precios, Parra Iglesias, Enrique Ediciones Akal, 2003. Recurso electrónico.
- Refining Processes Handbook, Parkash, Surinder, Ed. Gulf Publishing Company, 2003. Recurso electrónico.
- DIrección y gestión de la producción, Rodrigo, C. y Molí, J., Ed. Sanz y Torres, 2011.
- Guía de Mejores Técnicas Disponibles en España del sector refino de petróleo. Documento BREF. Recurso electrónico. Ministerio de Medio Ambiente, 2004.
- Guía de Mejores Técnicas Disponibles en España de fabricación de cemento. Recurso electrónico. Ministerio de Medio Ambiente, 2003.
- Documento de referencia de Mejores Técnicas Disponibles en la industria de fabricación de vidrio. Documento BREF. Recurso electrónico. Ministerio de Medio Ambiente, 2004.
- Mejores Técnicas Disponibles de referencia europea: Producción de polímeros. Documento BREF. Recurso electrónico. Ministerio de Medio Ambiente y Medio Rural y Marino. Traducción del original, 2009.

Additional

- Kirk-Othmer Encyclopedia of Chemical Technology. [executive editor: Jacqueline I. Kroschwitz ; editor: Arza Seidel] Hoboken (NJ) : Wiley-Interscience, cop. 2004-2007.
- Encyclopedia of Chemical Processing and Dessign, J. Macketta, William A. Cunningham. (editores), Ed. Marcel Dekker, 1977-...
- Ullmanns Encyclopedia of Industrial Chemistry. CD-ROM. 6th. Edition 1999. Electronic Release. Wiley-VCH.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

The contents initially collected in the teaching guide are maintained.

Volume of work and temporary planning of teaching

Regarding the workload:

The different activities described in the Teaching Guide are maintained with the planned dedication.

Regarding the temporary planning of teaching

The material for the follow-up of the classroom theory / practical classes allows to continue with the teaching planned (in both days and hours, and also if the teaching is classroom-based or not).

Teaching methodology

In the classroom theory and practical classes, there will be the maximum possible attendance, whenever the sanitary restrictions that limit the capacity of the classrooms to 50% of their usual occupation are accomplished. If the number of students enrolled exceeds the classroom capacity limit, it may be necessary to distribute the students in two groups in certain sessions that necessarily require attendance. If this situation arises, each group will attend classroom theory and practical sessions with physical presence in the classroom by rotating shifts, thus ensuring compliance with the criteria for occupying spaces. The rotation system will be established once the actual enrollment data is known, guaranteeing, in any case, that the attendance percentage of all the students enrolled in the subject is the same. For classroom sessions and theory sessions that are not face-to-face, there will be a preferably synchronous online teaching model, as long as compatibility with other scheduled activities is allowed. Online teaching will be carried out by synchronous videoconference respecting the schedule, or, if not possible, asynchronous.

Once the actual enrollment data is confirmed and the availability of spaces is known, the Academic Committee of the Degree will approve the Teaching Model of the Degree and its adaptation to each subject. Specific teaching conditions will be fixed for each subject.

If there is a closure of the facilities for sanitary reasons that totally or partially affects the classes of the subject, these will be replaced by non-contact sessions following the established schedules.

Evaluation

The evaluation system described in the Teaching Guide of the subject in which the different evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons that affect the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in on-line mode using the computer tools licensed by the University of Valencia. The contribution of each evaluable activity to the final grade for the course will remain unchanged, as established in this guide.

References

The references recommended in the Teaching Guide is kept as it is fully accessible.