VNIVERSITAT DE VALÈNCIA

Course Guide
34773 Process and product engineering II

COURSE DATA

Data Subject	
Code	34773
Name	Process and product engineering II
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

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 subject is articulated around three axes: theory classes, practical classes and tutorials.

Theoretical classes: The method of theory classes will be based mainly on the master class model. The teacher will show through presentations the contents of each topic focusing on 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 (consisting of 2-3 students) must carry out a detailed report on an industrial process. Then, this work will have to be exposed (oral presentation) to the teacher and classmates (G1, G2, G4, G5, G6, G7, G10, G11, TE1).

Tutorials: Regarding the tutorials, the teacher will discuss with the students and clarify both general aspects of the subject and particular issues (G1, G2, G4, G5, G6, G7, G11, TE1).

EVALUATION

First call

The evaluation of student learning will be carried out according to the following model:

The marks obtained in 2 individual tests will be considered. The evaluation will be carried out considering two independent blocks: Block I and Block II.

The test of block I will be carried out at the end of the subject of this block.

The block II test will be in the official date of the first call.

To pass the subject, students must have an average grade between the 2 individual tests equal to or greater than 5 points out of 10. (First Test Mark + Second Test Mark) / 2 greater than or equal to 5 points out of 10

The Final Mark will be calculated following the criteria:

37.5% Grade First Test (Block I)

37.5% Grade Second Test (Block II)

25% Grade of planned activities

In addition, to pass the subject in the first call, a Final Mark equal to or greater than 5/10 must be obtained.

Second call

In case of not passing the subject in the first call, the students will have a second call, in which there will be a single exam of the entire program of the subject (Block I and Block II).

To pass the course, students must have an exam grade equal to or greater than 5 points out of 10

The Final Mark will be calculated following the criteria:

75% Grade Final Test (second call)

25% Grade of planned activities

In addition, to pass the subject in the second call, a Final Mark equal to or greater than 5/10 must be obtained.

The Planned Activities are not recoverable, so to be graded they must be delivered on the dates stipulated by the faculties.

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

REFERENCES

Basic

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- 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.
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- 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

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- 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.