COURSE DATA

DATA SUBJECT

Code: 34772
Name: Process and product engineering I
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	3	Second quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Process and product engineering	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Cuarto curso	COMPULSORY

COORDINATION

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SUMMARY

The main objective of the subject Products and Processes Engineering I is to get the student achieve basic knowledge that will be useful to industrial chemical processes analysis from an integral perspective. He will be able to use industrial chemical processes simulation and optimization tools that him to analyze, design, control, simulate and optimize processes and products.

The contents of this subject include analysis, design, control, simulation and optimization of processes and products, and they will be developed in the thematic units described in this guide.

This is a quarterly mandatory subject that is taught in the third year of the degree in Chemical Engineering, along the second half year. In the curriculum being in force at present it consists of a total of 4.5 credits ECTS. This subject is part of a main subject (Products and Processes Engineering) which represents a global weight of 10.5 ECTS, 6.0 of them correspond to the second part that will be taught in the fourth year of the degree.

The subject implies an integration of all the knowledge previously developed in basic subjects of the Chemical Engineering and it introduces the necessary knowledge to propose optimal solutions to the typical problems about design and simulation of industrial installations, where the basic operations studied in other subjects are joined.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

In order to get a correct teaching-learning process of this subject it is recommended that the student has obtained the skills from the fundamental subjects of the Industrial branch (Applied thermodynamics and heat transfer, Fluid mechanics, and Dynamics and control), as well as from the subjects of the specific technology Industrial Chemistry: Basics of Chemical Engineering, Basic operations in Chemical Engineering, and Engineering of chemical reactions, which are studied in previous semesters.

It is also important to remember the knowledge and skills gained from the subjects of the first year: Mathematics II and III (with regards to the capability of setting up the solution procedure of problems by using mathematics and solving them by applying advanced concepts and numerical methods), and Informatics (which will be needed for developing and programming algorithms for the resolution of optimisation problems).

COMPETENCES / LEARNING OUTCOMES

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Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Analyse, design, simulate and optimise processes and products.

Analyse and evaluate the social and environmental impact of technical solutions.

Be able to understand and apply the legislation required for the practice of the profession of technical industrial engineer.

Design, manage and operate procedures for the simulation, control and instrumentation of chemical processes.

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

Solve problems with initiative, make decisions, think creatively and critically, and communicate and convey knowledge, skills and competences in the field of industrial engineering.

Understand material and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and the valorisation and transformation of raw materials and energy resources.

Work in a multilingual and multidisciplinary environment.

DESCRIPTION OF CONTENTS

1. Design and process integration

Types of processes in the chemical industry. Hierarchies of design and process integration. Process redesign. Industrial process control.

2. Process simulation in Chemical Engineering

Mathematical modelling of chemical processes: Types of models. Parameter estimation. Sensitivity and uncertainty analysis. Practical examples of process modelling.
Simulation tools: Introduction to the simulators. Components of a simulator. Simulation using spreadsheets. Simulation and optimization using Matlab®. Description and use of commercial simulators (Aspen Hysys®). Practical exercises on simulation and optimization with Hysys®.

3. Systems structure

System and subsystems. Interaction of systems. Degrees of freedom of a system. Information flow diagrams. Selection of the design variables.

4. Process optimization in chemical engineering

Basics of optimization: Objective function. Equality and inequality constraints. Properties of functions: topology, continuity, differentiability, monotony and convexity. Local optimum and global optimum. Types of optimization problems.
Nonlinear functions optimization: Analytical methods. Numerical optimization methods. Optimization of one-dimensional systems: five points method, golden section, Coggins method. Optimization of N-dimensional systems: direct search methods, gradient methods, advanced methods for global optimization. Optimization with Matlab ®. Practical optimization exercises in chemical engineering.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	25,00
Classroom practices	20,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	5,00
Independent study and work	10,00
Preparation of lessons	15,00
Preparation for assessment activities	17,50
Resolution of case studies	20,00
Total hours	**67,50**

TEACHING METHODOLOGY

The development of the course is structured around three axis: the theory classes, practical classes and tutoring classes:

Theoretical activities: In the lectures, through the participatory magisterial lesson, the topics will be developed by providing a global and inclusive perspective, analysing the key and more complex issues in detail, and always promoting student participation. For further preparation of the subject in depth by the student the appropriate resources will also be recommended.

Practical Activities: Practical classes will complement the theoretical activities in order to apply the basic concepts and extend them with knowledge and experience they acquire during the performance of the proposed work. This will be done in the classroom or in small groups. They include the following types of classroom activities:

- Classes of exercises and questions in the classroom. The professor will explain a number of sample exercises that allow students to acquire the necessary skills to analyse, formulate and solve the exercises of each theme. Some exercises will be resolved in small group practical classes.
- Discussion sessions and exercises/homework solving. In these sessions, which will be held in small groups, a series of exercises or works previously raised by the teacher and worked by the students in small groups will be analysed and discussed. These sessions will be conducted in small group practical classes.
- Practical activities in computer classroom. In these sessions, students will use the commercial simulator Aspen Hysys® for the practical application of knowledge and skills on design, simulation and optimization developed over the course. These sessions will be conducted in small groups.

Tutoring classes: The tutoring classes will arise as voluntary sessions to resolve any doubts arising in the resolution of problems or of the work that students must perform on their own. In addition, the teacher will guide the student on the most appropriate methodology for learning the fundamental knowledge of the subject.

For the development of all these activities both students and the teacher will use the platform called "Aula Virtual".

EVALUATION

The evaluation of student learning will take place via two optional modes. In a first option, the following items will be considered in the final mark: a continuous evaluation, with attendance and practical activities, and a final evaluation exercise. In the second option only a final evaluation exercise will be considered.

Continuous evaluation: It will be based on participation and involvement of the student in the teaching-learning process, considering: the regular attendance at classroom activities, and the resolution of proposed exercises either individually or in small groups. It will weight a 40% of the final mark.

Final evaluation exercise: The student must perform a single objective test, which will consist of an examination at the end of the semester that will be valued at 60% of the final mark. The exam will consist of both theoretical and practical questions and exercises in order to verify that the students have assimilated the basic concepts of the subject.

In sum, the evaluation of student learning for each mode will consist of:

Mode A:

Item	% ON FINAL MARK
Continuous evaluation	40
Final exam	60

Mode B:

Item	% ON FINAL MARK
Final exam	100

To pass the subject, it is necessary to obtain an average mark of 5 out of 10, provided that a mark equal to or greater than 4 points (out of 10) is obtained in the final exam.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

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" (ACGUV 108/2017).

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