# COURSE DATA

## DATA SUBJECT

**Code:** 34209
**Name:** Chemical Engineering
**Cycle:** Undergraduate Studies
**ECTS Credits:** 6
**Academic year:** 2025-26

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1110 - Degree in Chemistry | Facultat de Química | 3 | Second quarter |
| 1929 - Double Degree Program in Physics and Chemistry | Facultat de Física | 5 | Second quarter |

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|
| 1110 - Degree in Chemistry | Chemical Industry | COMPULSORY |
| 1929 - Double Degree Program in Physics and Chemistry | Quinto Curso (Obligatorio) | COMPULSORY |

## COORDINATION

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# SUMMARY

This subject provides students with the basic concepts of chemical engineering: material and energy balances, fundamentals of unit operations and principles of chemical reactors. Also, the aim of the course is to familiarise students with the most important chemical engineering processes. It is a compulsory subject taught in year 3 of the Degree in Chemistry and it is worth a total of 6 ETCS credits in the curriculum.

It is a very practical subject in which, after the introduction of concepts, students will carry out numerous practical exercises and conduct experiments in the laboratory.

# PREVIOUS KNOWLEDGE

## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

### OTHER REQUIREMENTS

To successfully address the subject, students require some previous knowledge of mathematics and chemistry, which must have been acquired in the subjects studied in previous years. Such knowledge includes:
- Calculation of enthalpy and heat of reaction
- Reaction rate
- Calculation of logarithms and exponentials
- Solution of systems of linear equations
- Solution of nonlinear equations
- Solution of immediate integrals

## COMPETENCES / LEARNING OUTCOMES

### -

Act autonomously in learning, making well-founded decisions in various contexts, forming judgements based on experimentation and analysis, and applying knowledge to new situations.

Address new problems and propose strategies to solve them.

Apply metrology in chemical processes, including quality management.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Communicate effectively both orally and in writing, adapting to the context and audience.

Contribute to the design, development and implementation of solutions that respond to social demands, using the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical thinking, considering professional ethics, moral values and social implications of the different activities carried out throughout the degree.

Evaluate the risks involved in the use of chemical substances and laboratory procedures.

Express ideas correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Identify chemical elements and their compounds, including their extraction, structure, reactivity, properties and applications.

Identify chemical processes in everyday life.

Identify the unit operations of chemical engineering.

Implement sustainable and environmentally friendly methodologies.

Interpret the relationship between the variation in the characteristic properties of chemical elements and the Periodic Table.

Prepare reports, assessments, and industrial and environmental projects in the field of chemistry.

Propose creative and innovative solutions to complex situations or problems in the field, addressing diverse professional and social needs.

Relate chemistry to other disciplines.

Relate theory to experimentation.

Understand and analyse, from the perspective of the degree programme, social inequalities based on sex and gender; integrate gender-sensitive approaches into problem-solving and solution design.

## DESCRIPTION OF CONTENTS

### 1. INTRODUCCTION

Definition of chemical engineering. Chemical process. Forms of operation in the chemical industry. Basic operations.

### 2. MATERIAL BALANCES

Introduction. Total mass balance. Mass balance applied to a component. Non-reacting systems in steady state. Reacting systems in steady state. Non-reacting systems in unsteady state.

### 3. ENERGY BALANCES

Total energy balance. Balance of heat energy. Application to non-reacting systems in steady state. Application to reacting systems in steady state. Application to non-reacting systems in unsteady state. Mechanical energy balance.

## 4. INTRODUCTION TO DESIGN OF REACTORS

Classification. Batch or semi-batch reactors. Continuous flow reactors. Continuous tubular reactor (Plug flow reactor).

## 5. FUNDAMENTALS OF UNIT OPERATIONS

Transport mechanisms. Molecular transport: transport equations. Conduction heat transfer. Turbulent transport: transport equations. Heat exchanger analysis and design.

## 6. PRACTICAL LABORATORY

The objective of these laboratory sessions is to show students the experimental methods used in chemical engineering in order for them to learn how to use different equipment and devices for industrial applications, to take measurements with accuracy and precision, to carry out calculations methodically and to write clear reports of the experiments carried out.
Practical sessions:
- Mass balance applied to a component in unsteady state
- Energy balance in unsteady state
- Hydrolysis of ethyl acetate on a batch reactor

# WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Tutorials | 7,00 |
| Theory | 41,00 |
| Laboratory | 12,00 |
| **Total hours** | **60,00** |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 25,00 |
| Independent study and work | 0,00 |
| Preparation of lessons | 48,00 |

| | |
|---|---|
| Preparation for assessment activities | 17,00 |
| Resolution of case studies | 0,00 |
| **Total hours** | **90,00** |

## TEACHING METHODOLOGY

The development of the subject is structured around theoretical and problem-based lessons, laboratory practices and projects.

Theory lectures will serve to present and/or explain the main contents of each unit from which the lecturer will highlight the key aspects.

Practical problem-based lessons will be delivered following two models. In some of the classes, the lecturer will solve a series of sample problems in order to teach students to identify the essential elements in the statement and in the solution of problems. In other practical lessons, students, either individually or in teams, will have to solve similar problems under the supervision of the lecturer.

For laboratory practice sessions, students will have scripts. Experimental sessions will be carried out entirely by them under the supervision of the lecturer.

The work proposed to students will be divided into two types:

a) complete problems with similar complexity to those in exams, aimed at reviewing the most important concepts of each unit

b) self-correcting tests, completed on the Virtual Classroom.

Throughout the course students will receive the corrected materials so that they can work on unfamiliar concepts.

## EVALUATION

The subject consists of a theoretical part and other part from experimental practices.

The evaluation of experimental practices will be obtained from the reports of results presented of three practices realized (average score ≥ 5.0) and the corresponding practice exam. The mark for the exam has to be equal to or greater than 3.0.

The assessment will be obtained as: theoretical part (80%) and other part from experimental practices (20%) [EVAL 1]. The theoretical part includes activities carried out by the students (10%) [EVAL 4] and the

exam performed (70%) [EVAL 3]. The mark for the exam has to be equal to or greater than 4,5.

*The mark for the theoretical part and the mark for the part from experimental practices must be ≥ 5,0.*

*An examination advance to finish the Grade studies will be able to be requested only if the laboratory associated with the subject is approved.*

The laboratory sessions is a non-recoverable and obligatory activity for the course to be passed.

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).

**Final warning**

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

## REFERENCES


- AUCEJO PEREZ A. et al. Introducció a lEnginyeria Química, Barcelona: Biblioteca Universitaria, 2010. 688 p. ISBN: 978-84-7306-556-6
- FELDER, R.M.; ROUSSEAU. R.W Principios Elementales de los Procesos Químicos, Wilmington: Editorial Addison-Wesley Iberoamericana (2ª Edición),1991. 729 p. ISBN: 0201629526
- CALLEJA, G. et al., Introducción a la ingenieria química, Madrid: Síntesis, 1999. 523 p. ISBN:

8477386641

- COSTA NOVELLA, E. Ingeniería química. Vol. 1, Conceptos generales / Enrique Costa Novella ; con la colaboración de J.L. Sotelo Sancho ... [et al.] . - [1a. ed.] Madrid : Alhambra, 1983. 257 p. ISBN: 8420509906

- REKLAITIS, G. V., Introduction to material and energy balances, New York: Wiley, 1983. 683 p. ISBN: 0471041319

- COSTA LÓPEZ, J. et al., Curso de química técnica: introducción a los procesos, las operaciones unitarias y los fenómenos de transporte en la ingeniería, Barcelona: Reverté, 1985. 440 p. ISBN: 8429171266

- LEVENSPIEL O. Ingeniería de las Reacciones Químicas, Barcelona: Ed. Reverté, 1990. 638 p. ISBN: 8429173250