# COURSE DATA

## DATA SUBJECT

**Code:** 34755
**Name:** Basis of chemical engineering I
**Cycle:** Undergraduate Studies
**ECTS Credits:** 6
**Academic year:** 2025-26

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1401 - Degree in Chemical Engineering | Escola Tècnica Superior d'Enginyeria | 1 | Second quarter |
| 1934 - Double Degree Program in Chemistry-Chemical Engineering | Facultat de Química | 1 | Second quarter |

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|
| 1401 - Degree in Chemical Engineering | Foundations of chemical engineering | COMPULSORY |
| 1934 - Double Degree Program in Chemistry-Chemical Engineering | Primer curso | COMPULSORY |

## COORDINATION

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# SUMMARY

The subject Basis of Chemical Engineering I is part of the material of the same name whose overall objective is that any student acquire and apply the basic principles of chemical engineering for subsequent application to the design and operation analysis of chemical reactors and different types of basic operations of the process industry. It is a compulsory subject that is given in the first year of the Grade in Chemical Engineering during the second quarter. The curriculum consists of a total of 6 ECTS.

This course aims to give an overview of chemical engineering and provide with the skills to apply one of the fundamental tools for analysis and design of any process equipment: macroscopic property balances. Thus, the basis necessaries for students to begin to know and understand the objectives of the studies and profession are established and then they successfully study subjects of calculation and design of equipment of the process industry.

This is a very practical subject in which, after the introduction of concepts, students will take numerous practical exercises will be taken, primarily related to the resolution of material and energy macroscopic balances, as well as experimentation in the laboratory.

The **general objectives** of the course are:

- Introduce the students to the basic features of the process industry, the modes of operation in the industry and the concept of unit operation.
- Ensure that students acquire and properly use the basic terminology and nomenclature of chemical engineering.
- Develop the students' ability to pose and solve numerical problems of property balances, and to interpret the results.
- Enhance students' skills in reasoning and making systematic work.
- Introduce students to the experimentation in the field of chemical engineering. Develop students' skills to work in the laboratory, to collect and process data and report the results.

The **subject contents** are: Material and Energy macroscopic balances. Introduction to experimentation in chemical engineering.

**Remarks**: Theoretical, classroom practices and laboratory practices classes will be taught in the language according to the subject information available on the degree website.

## PREVIOUS KNOWLEDGE

### RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

### OTHER REQUIREMENTS

It is recommended to have the following previous knowlegde:

- International system of units. Unit changes.
- Expression of the concentration of mixtures.
- Chemical equation and elementary stoichiometric calculations.
- Thermodynamics: enthalpy, heat of reaction and equilibrium.
- Use of logarithms and exponentials.
- Solving systems of linear and nonlinear equations.
- Solving immediate integrals.
- Solving simple differential equations.
- Making graphs of experimental data.

## COMPETENCES / LEARNING OUTCOMES

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Acquire knowledge of basic and technological subjects to facilitate the learning of new methods and theories, and develop the versatility to adapt to new situations.

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

Design and manage applied experimental procedures, especially for determining thermodynamic and transport properties, and model phenomena and systems in chemical engineering, fluid flow systems, heat transfer, mass transfer operations, chemical reaction kinetics and reactors.

Know how to communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

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.

## DESCRIPTION OF CONTENTS

### 1. INTRODUCTION TO CHEMICAL ENGINEERING

Industrial activity. Chemical process industry and Chemical Engineering. Continuous and batch mode. Steady and unsteady state. Unit operation. The chemical engineer in the chemical industry. General approach to the analysis and design of systems. Systems of units.

### 2. CONSERVATION LAWS. MACROSCOPIC MATERIAL BALANCES

Formulation of balances. Process variables. Total mass balance. Total amount of substance balance. Mass balance applied to a component. Amount of substance balance applied to a component. Application of material balances: analysis of systems with a single unit; analysis of systems with several units; non reacting systems in steady state; reacting systems in steady state; non reacting systems in unsteady state.

### 3. MACROSCOPIC ENERGY BALANCES

Total energy balance. Expression of different terms: enthalpy, potential energy, kinetic energy. Heat energy balance. Application of heat energy balance: non reacting systems in steady state; reacting systems in steady state; non reacting systems in unsteady state. Mechanical energy balance.

# 4. BASIS OF CHEMICAL ENGINEERING I LABORATORY

Introduction to the laboratory. Material balance in unsteady state. Energy balance in unsteady state. Calculations and reporting.

## WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Theory | 15,00 |
| Laboratory | 13,00 |
| Classroom practices | 32,00 |
| **Total hours** | **60,00** |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 28,00 |
| Independent study and work | 0,00 |
| Preparation of lessons | 34,00 |
| Preparation for assessment activities | 28,00 |
| Resolution of case studies | 0,00 |
| **Total hours** | **90,00** |

## TEACHING METHODOLOGY

The development of the subject is structured around the theoretical and problem classes, laboratory practices and performing work.

In the theoretical classes model of lecture will be used. The teacher will present and/or explain the main contents of each issue to highlight those key aspects for subject understanding.

Practical sessions of problems will be developed following two models. In some of the classes, the teacher will solve a series of sample problems in order to teach students to identify the essential elements of the problem approach and resolution. In other kinds of practical sessions the students, individually or arranged in clusters, will solve similar problems under the teacher supervision. After the work has been completed, the problems will be collected, analyzed and corrected.

For laboratory practice sessions some activities will be programmed to introduce the practice to be carried out, experimental activities of laboratory data acquisition and analysis activities of data treatment. Students will have practice scripts and experimental sessions will be carried out entirely by them under the supervision of the teacher.

The proposed work will be of several types: Theoretical questions, Numerical questions, Problems, Self-corrective Tests to be done in Virtual Classroom and Laboratory reports. Some of these activities will be held in class and the rest of the activities will have a compulsory performance and submission timetable. After correction, the students will be informed of their results so he/she can work the concepts that have been more confusing and generated more mistakes.

## EVALUATION

Attendance at the laboratory of experimental practices is a non-recoverable and compulsory activity to overcome the subject.

The assessment of learning in the first and second call will be carried out through the independent assessment of the theory / problems part and the laboratory part.

**Theory and Problems Part (TP)**

Learning assessment of this part of the subject will be accomplished from the evaluation of the activities carried out and the mark of an exam of the theory/problems part of the subject (Objective Test, PO) that will be performed on the date of the official call.

Throughout the course, a series of activities will be proposed that will constitute the continuous evaluation of the subject. A compulsory schedule will be established for the performance and delivery of activities. All the face-to-face activities of continuous assessment will be carried out at the usual time of the subject. Continuous evaluation activities are non-recoverable.

The activities to be carried out are:

- Problem solving (RP): approach and/or resolution of problems.
- Questionnaires (Q): nomenclature, concepts, and interpretation of block diagrams.

Regarding the Objective Test (PO), a minimum mark of 5 out of 10 is required. Once this requirement is passed the mark for the theory / problems part (TP) will be obtained as:

Theory/problems Mark (TP) = 0,30·(RP) + 0,10 (Q) + 0,60 (PO)

To pass the course, a minimum mark of 5 out 0f 10 is required for the theory/problems part.

**Laboratory Part (PL)**

It will be evaluated from the qualifications of the preliminary questionnaires of the practices to be carried out, the reports of the practices performed and the mark of a Practices Exam that will be carried out:

- on the first call, in the usual schedule of the subject.
- on second call, on the official date of the call.

The mark of the Laboratory Practices will be obtained by weighting between the mark of the preliminary questionnaires (5%), the average mark of the practice reports (75%), and the mark of the Practice Exam (20% if the mark is greater than 5; 0% if the grade is less than 5) provided that the following requirements are met:

- Attendance at all the Laboratory Practice sessions, including the introductory session and the calculation sessions.
- Minimum mark of 5 out of 10 in each of the Laboratory Practice reports.

To pass the course, a minimum mark of 5 out of 10 is required for the laboratory part.

The mark of the Laboratory Practices if marks lower than the minimum required (5) have been obtained in the practice reports, will be the lowest of them.

**Final Mark**

The Final Mark of the subject, provided that a grade equal to or greater than 5 has been obtained in the TP and PL parts, will be:

Final Mark = 0.80 (TP) + 0.20 (PL)

If the TP Mark and/or the PL Mark is less than 5, the Final Score will be the lower of them.

- If the subject has not been overcome in the first call because the mark of the Laboratory Practices does not reach the required minimum, but the theory/problems part has been passed, the theory/problems grade (TP) is kept for the second call. In order to pass the course, the practical reports will have to be presented on the second call and/or take the Practices Exam. The deadline for the delivery of the practical reports is the one established for the official exam of the second call. The evaluation of the Laboratory Practices, the requirements to pass the subject and the final mark will be those described above.
- If the subject has not been overcome in the first call because the mark for the theory/problems part is less than 5 out of 10 but the Laboratory Practices have been passed, the mark of the Laboratory Practices (PL) is kept for the second call. In order to pass the subject, the exam of the theory/problems of the subject (PO) will have to be taken on the date of the official announcement. The requirements to pass the course and the final mark will be those described above.

The Final Mark on the second call if the subject has not been overcome for having obtained marks below the required minimum, will be the lowest of them. Failure to attend the exam of the second call (PO) will mean the grade Not presented (NP).

According to the Regulation of the advanced call to complete the studies of Degree (ACGUV 30/2015), the Academic Grade Commission establishes that in this subject it is not possible to request the advanced call if the student has not exceeded, prior to the request, the laboratory practices.

Anyway, 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).

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).

## REFERENCES


- "Principios Elementales de los Procesos Químicos" R. M. Felder, R. W. Rousseau (Ed. Addison-Wesley)
- "Material and Energy Balances" G.V. Reklaitis (Ed. Wiley)
- "Introducció a l'Enginyeria Química" A. Aucejo y otros (Enciclopèdia Catalana)
- "Principles of Chemical and Engineering Processes" N. Ghasem, R. Henda (Ed. CRC Press)
- "Ingeniería Química". Vol. 1. E. Costa Novella y Otros (Ed. Alhambra)
- "Cálculo de Balances de Materia y Energía" E. J. Henley, E.M. Rosen (Ed. Reverté)
- "Principios Básicos y Cálculos en Ingeniería Química" D. M. Himmelblau (Ed. Prentice Hall)
- "Problemas de Balances de Materia" A. Valiente, R. Primo Stivalet (Ed. Alhambra)
- "Problemas de Balances de Energía" A. Valiente, R. Primo Stivalet (Ed. Alhambra)
- "Balances de Materia. Problemas resueltos. I. Procesos sin reacción química". II. Procesos con reacción química" J.J. Peiró, J. García (Universidad Politécnica de Valencia)
- "Curso de Ingeniería Química" J. Costa López y otros (Ed. Reverté)
- "Handbook on Material and Energy Balance. Calculations in Materials Processing" (3rd Edition) A.E. Morris, H.A. Fine, G. Geiger (Ed. Wiley-TMS) Recurso electrónico