

**COURSE DATA****DATA SUBJECT****Code:** 34763**Name:** Chemical engineering laboratory I**Cycle:** Undergraduate Studies**ECTS Credits:** 4.5**Academic year:** 2026-27**STUDY (S)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	3	First quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	3	First quarter

**SUBJECT-MATTER**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1401 - Degree in Chemical Engineering	Experimentation in chemical engineering	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Tercer curso	COMPULSORY

**COORDINATION**

BOUZAS BLANCO ALBERTO

**SUMMARY**

The objective of this course is to develop in students the ability to plan and carry out experimental studies of different difficulty levels in facilities similar to those of a chemical process industry, to explain the results obtained and to make reports.

The contents of the subject revolve around the design and performance of experiments in the field of chemical engineering, especially in systems with fluid flow, heat transmission and separation operations.

Remarks: Classes will be taught in the language assigned to each laboratory subgroup as it appears in the subject description file 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

To deal successfully with this subject is recommended that the student is enrolled in the subjects:

- Applied Thermodynamics and Heat Transfer
- Fluid mechanics
- Basic Operations of Chemical Engineering

in accordance with the requirements established for each subject matter.

It is also recommended that the student possesses a number of previous knowledge for the level required in courses taken previously. These skills include:

- Basic laboratory techniques
- International System of Units. Change units
- Spreadsheet, user level
- Balance of property
- Transport phenomena

## COMPETENCES / LEARNING OUTCOMES

### 1401 - Degree in Chemical Engineering

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

Knowledge for carrying out measurements, calculations, valuations, appraisals, expert opinions, studies, reports, work plans and other similar work.

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.

Work in a multilingual and multidisciplinary environment.



## DESCRIPTION OF CONTENTS

### 1. HEAT TRANSFER BY CONDUCTION IN NON STEADY-STATE CONDITIONS.

Determination of the thermal conductivity of a solid.

### 2. HEAT TRANSFER IN BOILING.

Study of the three types of boiling: convective boiling, nucleated boiling and film boiling. Calculation of the individual coefficient of heat transport at different pressures.

### 3. TUBULAR HEAT EXCHANGER.

Determination of the overall coefficient of heat transmission. Comparison of experimental and theoretical coefficient. Determination of the heat exchanger efficiency.

### 4. EXPERIMENTAL STUDY OF THE FLUIDISATION.

Fluidization of beds of glass particles of different diameters with air and water. Determination of the pressure loss caused by the bed. Estimation of the minimum fluidization velocity.

### 5. FLOW OF AIRE THROUGH BEDS OF PARTICLES.

Determination of the pressure loss caused by beds of glass spheres of different heights in two columns of different diameters. Check the Karman-Cozensky equation.

### 6. CIRCULATION OF FLUIDS.

Calibration of a venturi and a diaphragm. Determination of the pressure loss on a straight stretch and various accidents. Study of the variation of the constant  $k$  for valves at different positions.

### 7. DETERMINATION OF THE CHARACTERISTICS OF A CENTRIFUGAL PUMP

Study of the behaviour of a centrifugal pump at various speeds of rotation. Obtention of the characteristic curves of the pump. Study of the cavitation.



## 8. MULTI-PUMP EQUIPMENT

Kinetic study of three pumps: centrifugal, axial and peripheral. Obtention of the characteristic curves of the pumps. Study of a positive displacement pump (gear). Regulation of its flow with the speed of rotation.

## 9. EXPERIMENTAL STUDY OF THE AGITATION

Study of the formation of vortices in straight blade agitators (short and long, of different widths), turbine and propeller. Calculation of the power consumption of the different agitators.

## 10. SIMPLE DISTILLATION

Two components mixture separation by distillation. Checking of total molar balance. Checking of vapor-liquid equilibrium data. Checking of Lord Rayleigh's equation.

## WORKLOAD

### PRESENCIAL ACTIVITIES

Activity	Hours
Laboratory	45,00
Classroom practices	22,50
<b>Total hours</b>	<b>67,50</b>

### NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	32,00
Independent study and work	0,00
Preparation of lessons	9,00
Preparation for assessment activities	4,00
Resolution of case studies	0,00
<b>Total hours</b>	<b>45,00</b>

## TEACHING METHODOLOGY

The students, in groups of two, will carry out the experimental part of 7 of the proposed practices in the laboratory, in sessions of five hours, according to the schedule of the group in which they are enrolled. One of the laboratory sessions will be dedicated to the preparation, by the students, of an experimental procedure for one of the proposed practices. This procedure will be presented to the professor at the end of the session and, once the student has the approval of the teacher, it will be put into practice in a subsequent laboratory session.



The students will have scripts for practices that can be downloaded from the e-learning platform ("Aula Virtual") of the University of Valencia and experimentation will be carried entirely by them under the supervision of the teacher.

Prior to conducting the practice in the laboratory, the students will answer a questionnaire about it. This will verify that they have read the script for practice and have prepared it accordingly. Both during the practice and its completion, they will have to perform calculations in cases where the teacher deems it appropriate.

Several sessions conveniently inserted between the sessions in laboratory, will be devoted to the elaboration of the calculations of the realized practices. A final session will consist of an oral presentation of one of the practices conducted at the laboratory. Students will prepare a written report of all the practices except for the oral exposed one. The report and the oral presentation will be made in group, although the note of the oral presentation will be individual.

In these reports, the students should properly present the results, calculations, discussion of results and conclusions reached in the development of practices. Also, they will attach a copy of the experimental data taken in the laboratory with the date of the practice and the teacher signature. In the "Aula Virtual" the students will have a guide of recommendations to prepare the practice reports.

At the end of the course the student will make an individual theory exam to demonstrate the knowledge acquired in the course.

Both for the preparation of the practice reports as the written exam, students have a few hours of tutorials in which they can raise doubts and questions they wish to teachers of the subject. Many of these questions can be answered easily by using the e-mail.

## EVALUATION

The evaluation of the subject will be carried out by evaluating the following points:

- The continuous evaluation of the students (10% of the final grade) where the motivation and degree of autonomy in the preparation and performance of the practices will be assessed through questionnaires prior to the completion of each practice.
- The practice reports presented and the oral presentation of one of the practices. The average of all these activities represents 70% of the final grade.
- The individual theoretical exam (20% of the final grade) that will be carried out:
  - in the first call, in one of the sessions of the usual schedule of the subject.
  - in the second call, on the official date of the call.

To pass the subject it will be required a minimum overall grade of 5 out of 10.



Some of the tests, or some of the parts of these, will required a minimal grade to pass the course. These minimum requirements are the following:

- The average of the questionnaires prior to each practice must be 5 out of 10. This minimum is a requirement to be able to take the theoretical exam. If students do not achieve this minimum, they will they will go directly to the second call where they will have to obtain this minimum prior to the theoretical exam.
- A minimum score of 3 out of 10 both in each report and in the oral presentation. In addition, the average between the reports of practices and the oral presentation will have to be 5 out of 10. If students do not obtain the minimum of 3 in each practice or the minimum of 5 in the average of reports and oral presentation, they will have to repeat reports in which they have obtained a grade lower than 5 on the second call. The oral presentation will be made up by presenting a written report on the second call.
- A minimum mark in the exam of 4 out of 10. If students do not obtain this minimum, they will have to repeat the exam on second call.

If, having passed the minimum required (5 in the questionnaires, 3 in each report and oral presentation and 5 in the average of these and 4 in the exam) students do not achieve the minimum final grade of 5, students will have to repeat the exam on second call.

Attendance at all sessions is mandatory and necessary to pass the subject and, furthermore, it is an activity that cannot be recovered on second call.

Failure to comply with the established schedule or laboratory rules will negatively influence the final grade.

In case of not passing the subject in the second call, the student will have to repeat all the activities the following year.

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](#)).

In any case, the evaluation system shall be governed by the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters ([ACGUV 108/2017](#)).

## REFERENCES

- Guías de las prácticas disponibles en la plataforma de e-learning (Aula Virtual) de la Universitat de València.
- Introducción a la Ingeniería Química G. Calleja y col. (Editorial Síntesis, 1999)



- Mecànica de Fluids A. V. Orchillés, M. Sanchoello (Publicacions Universitat de València, 2007)
- Transmissió de Calor M. Sanchoello, A. V. Orchillés (Publicacions Universitat de València, 2007)
- Consultar la bibliografía recomendada en las asignaturas Mecánica de Fluidos y Termodinámica y Transmisión de Calor.