VNIVERSITAT DE VALÈNCIA

Course Guide
34763 Chemical engineering laboratory I

COURSE DATA

Data Subject	
Code	34763
Name	Chemical engineering laboratory I
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	3	First term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	18 - Experimentation in chemical engineering	Obligatory

Coordination

Name	Department
BOUZAS BLANCO, ALBERTO	245 - Chemical Engineering

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 necessary 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 necessary 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

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1401 - Degree in Chemical Engineering

- 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.
- G10 - Ability to work in a multilingual and multidisciplinary environment.
- TE3 - Ability to design and manage applied experimental procedures, especially for determining thermodynamic and transport properties, and modelling of phenomena and systems in the field of chemical engineering, systems with fluid flows, heat transfer, matter transfer operations, kinetics of chemical reactions and reactors.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

1. Manage different equipment and devices of industrial application. (G5, TE3)

2. Take measures with accuracy and precision. (G5)

3. Propose experimental devices to understand and apply the basic principles of Chemical Engineering. (G4, G5, TE3)

4. Operate equipment in facilities of the chemical process industry. (G4, G5, TE3)

5. Be able to analyze equipment, to assess their suability and to propose alternatives. (G4, G5, TE3)

6. Select and apply appropriate mathematical methods to get results from the data obtained in the laboratory. (G4)

7. Analyze critically the results obtained in the laboratory. (G4)

8. Write clearly, understandably and organized reports of work done in the laboratory. (G4, G10)

9. Finding, selecting and understanding the information in specialized literature sources. (G10)

10. Acquire ability to work in groups. (G10)

DESCRIPTION OF CONTENTS

1. HEAT TRANSFER BY CONDUTION 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

ACTIVITY	Hours	% To be attended
Laboratory practices	45,00	100
Classroom practices	22,50	100
Development of group work	32,00	0
Preparation of evaluation activities	4,00	0
Preparation of practical classes and problem	9,00	0
TOTAL	**112,50**	

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.

In all aspects of this methodology the above-mentioned powers are involved to greater or lesser extent. (G4, G5, G10, TE3).

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. (G4, G5, G10, TE3)
- 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. (G4, G5, G10, TE3)
- The individual theoretical exam (20% of the final grade). (G4, G5, G10, TE3)

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. 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.

In any case, the evaluation system shall be governed by the Regulation of Evaluation i Qualification of the University of Valencia for Degrees and Masters.

REFERENCES

Basic

- 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. Sanchotello (Publicacions Universitat de València, 2007)
- Transmissió de Calor M. Sanchotello, A. V. Orchillés (Publicacions Universitat de València, 2007)

Additional

- Consultar la bibliografía recomendada en las asignaturas Mecánica de Fluidos y Termodinámica y Transmisión de Calor.