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	2020 - 2021

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
PEÑA MARTINEZ, MARIA PILAR	245 - Chemical Engineering

SUMMARY

The objective of this course is that students are able to plan and carry out experimental studies of varying degrees of difficulty in facilities similar to those of a chemical process industry, to explain the results and reporting.

Contents:

Design and conduct experiments in the field of Chemical Engineering, especially in systems with fluid flow, heat transfer and separation operations.

Remarks: Classes will be taught in the language assigned to the subgroup of laboratory as stated in the course sheet 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.
Internati

OUTCOMES

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

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. MULTIPLE HEAT EXCHANGER.

Comparison of the efficiency of the three heat exchangers presents in the heat exchanger multiple (coil, plates and shell and tube).

5. EXPERIMENTAL STUDY OF THE FILTRATION.

Filtration of a ceramic paste at different pressures. Calculation of the resistance and the porosity of the cake and study of their variation with pressure.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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, performed in the laboratory the experimental part of 8of the previously related practices, in sessions of five hours, according to the schedule of the group they belong to.

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. After the practice, students will also make calculations in those cases in which the teacher deems it timely.

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 exposure of one of the practice conducted in the laboratory. Students will prepare a written report of all the practices with the exception of the oral exposed one. The report and the oral exposure will be made in group, although the note of the oral exposure 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 in order 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 assessment of the matter will be carry out on an ongoing basis, by assessing the following:
• The motivation and degree of autonomy in preparing and conducting practices by the student.
• The practice reports submitted.
• The oral exposure of the seventh practice.
• The individual theoretical exam.

The final mark of this module will be obtained from the mark of the questionnaires before and after the completion of practice (10%) (G4, G5, G10, TE3),, the theoretical exam (20%) (G4, G5, G10, TE3),, and the average of the laboratory reports and oral presentation (70%) (G4, G5, G10, TE3),. The student will need to obtain a minimum score of 5 out of 10 to pass the course.

Some of the parts will be minimal and therefore the student will need to overcome them to pass the course. Thus, students must obtain a minimum score of 3 out of 10 on the theoretical exam, to mediate with the other parties. Also, they must obtain a minimum score of 5 out of 10 on the average of the practice reports and oral exposure. Breach of the established schedule or laboratory rules will negatively influence the final grade.

If the students do not obtain a minimum of 3 on the exam, they must repeat the same on second call. If the students do not obtain a minimum of 5 on the average of the practice reports and oral exposure, they must repeat the reports of practices with a mark lower than 5. When the students have a mark exceeding the minimum of 3 on the exam and 5 on the average of the practice reports and oral exposure, but they do not reach the minimum final mark of 5, the students must retake the exam on second call.

Attendance at all sessions is mandatory and necessary to overcome the subject and is a non-recoverable activity in second call.

In any case, the evaluation system shall be governed by the Reglament d'Avaluació i Qualificació de la Universitat de València per a Títols de Grau i Màster (https://goo.gl/UdDYS2).

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.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

The contents initially included in the Course Guide are maintained.

Workload and time planning of teaching

Regarding the workload:

The different activities described in the Teaching Guide are maintained with the planned dedication.

Regarding the time planning of teaching:

The temporary planning of the teaching staff is maintained, both in terms of days and hours.

Teaching methodology

Attendance at the sessions scheduled in the timetable will be entirely on a face-to-face basis.

If there is a closure of the facilities for health reasons that affects all or part of the classes of the subject, these will be replaced by non-attendance sessions following the established schedules.

Evaluation

The evaluation system described in the Course Guide is maintained, in which the different evaluable activities and their contribution to the course final grade are specified.

If the facilities are closed for health reasons that affect the development of any assessable activity of the course, this will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the University of Valencia. The contribution of each assessable activity to the final qualification of the course will remain unchanged, as established in this guide.

Bibliography

The bibliography recommended in the Course Guide is maintained as it is accessible.