Course Guide
34764 Chemical engineering laboratory II

COURSE DATA

Data Subject	
Code	34764
Name	Chemical engineering laboratory II
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	Second term

Subject-matter

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

Coordination

Name	Department
LLOPIS ALONSO, FRANCISCO	245 - Chemical Engineering

SUMMARY

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

specifically:

• work with different equipment and devices for industrial applications related to chemical reactors.

• make measurements with accuracy and precision.

• proceed methodically in carrying out the calculations.

• write clearly reports the practices.

Contents: Design and conduct experiments in the field of chemical engineering, especially in systems with fluid flow, chemical reaction kinetics and reactors.

The course is obligatory and is offered in the third year of the degree of Chemical Engineering in the second semester. The laboratory classes will be taught in Spanish as stated in the course information available on the website of the degree.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Have adquired the skills of the subjects:
* Chemical reaction engineering I and II

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.
- TE1 - Knowledge of material and energy balances, biotechnology, matter transfer, separation operations, chemical reaction engineering, reactor design, and valorisation and transformation of raw materials and energy resources.
- 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)

Manage multiple computers and devices of industrial application. (Outcomes G5)

Take measures with accuracy and precision. (Outcomes G5)

Ask experimental devices to understand and apply the basic principles of chemical engineering. (Outcomes G4, TE1, TE2)

Operate equipment in facilities of the chemical process industry. (Outcomes G4, TE1, TE2)

Ability to analyze equipment, to assess their suitability and to propose alternatives. (Outcomes G4, TE1, TE2)

Select and apply appropriate mathematical methods to get results from the data obtained in the laboratory. (Outcomes G4, TE1, TE2)

To analyze critically the results obtained by performing the labs. (Outcomes G4)

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

Find, select and understand the information in specialized literature sources. (Outcomes G5)

To acquire the ability to work in groups. (Outcomes G10)

DESCRIPTION OF CONTENTS

1. Analysis of a battery of continuous stirred tank reactors

Analysis of a battery of two continuous stirred tank reactors. Steady-state study the process of ethyl acetate with sodium hydroxide. Influence of residence time. Preparation and titration of solutions

2. Analysis of a series of continuous stirred tank reactor

The analysis of a series of continuous stirred tank reactor and two continuous tubular reactors. Study of steady state and unsteady. Study of the DTR. Kinetics of crystal violet decoloration process. Influence of residence time. Preparation and titration of solutions.

3. Study of the best arrangement of several reactors ideal in a multiple reactor system

Study of the best arrangement of several reactors ideal in a multiple reactor system. Steady-state study the process of phenolphthalein with soda. Kinetics of the process. Influence of residence time. Preparation and titration of solutions.

4. Analysis of a adiabatic batch stirred tank reactor

Analysis of a adiabatic batch stirred tank reactor. Study of the kinetics of sodium tiosultate process with hydrogen peroxide. Influence of temperature and relative proportions of reactants. Preparation and titration of solutions.

5. Study of the kinetics of a discontinuous process in a stirred tank reactor

Kinetic study of basic hydrolysis of the ethyl acetate, in a batch stirred tank reactor. Titration of solutions. Influence of the temperature.

6. Study of the flow not ideal, in a battery of continuous reactors

Study of the flow not ideal, in a battery of continuous reactors. Influence of pulse signal introduced. Analysis of the DTR. Study of model by-pass and dead space. Study of the model of reactors in series.

7. Flow model of a battery of reactors in series

Flow model of a battery of reactors in series. Influence of the type of signal input. Analysis of the DTR. Comparison with the ideal models.

8. Study of the catalytic oxidative dehydrogenation of n-butane.

Study of the catalytic oxidative dehydrogenation of n-butane. Analysis of the yield and selectivity of the process. Influence of residence time. Basics concepts of applied catalysis. Chromatographic analysis

9. Reactor simulation

Reactor simulation by hydraulic means. Reactor simulation by computer.

10. Acid Ethyl acetate hydrolysis in a jacketed reactor

Study of the kinetics of the ethyl acetate hydrolysis, by homogeneous catalysis in acid medium, by means of a volumetric method, at different temperatures, in a jacketed semi-continuous stirred reactor. With the values of the kinetic constants obtained, verify compliance with the Arrhenius equation, and determine the value of the activation energy of this reaction.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	45,00	100
Classroom practices	22,50	100
Development of group work	23,00	0
Study and independent work	5,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Resolution of online questionnaires	2,00	0
TOTAL	112,50	

TEACHING METHODOLOGY

The experimentation will be carried out entirely by the students under the supervision of the professor, by-pairs, in the laboratories of the Department of Chemical Engineering. The competencies G4, G5, TE3 will be worked on.

The course will be developed considering several aspects:

i) Preparation of the experience to be carried out. The student will have the script of each of the practices to be carried out, in the e-learning platform (Virtual Classroom) of the University of Valencia, as well as a series of questions related to the theoretical concepts and the experimental procedure that are used in each one of them. These questions will be resolved and reviewed before starting the practice. With the practice script, these questions and the material and information provided by the teacher, the student must prepare the experiments to be carried out.

ii) Work in the laboratory. An important part of laboratory work is collecting laboratory data. The students will write down on some sheets the observations and data obtained during the experience together with the data processing and calculations necessary to conclude the experience. Said information will be at the disposal of the teaching staff at any time so that they can proceed to review it and must be presented at the end of the laboratory session to be sealed.

iii) Treatment of the results obtained. The treatment of results will begin in the laboratory so that the teacher guides on it and later the student completes it. One aspect to take into account when presenting the results is the proper use of the units and the corresponding significant figures. Likewise, it is important that students learn to draw up tables and figures in which the data obtained is collected.

iv) Memories of the practices carried out. One of the objectives of this subject is that the student becomes familiar with the presentation of a scientific work, for this each student will present a report. Said work will be prepared by-pairs and will be presented within the term set by the teaching staff. In the Virtual Classroom they will have a guide of recommendations when preparing a report of a practice. The skills G5, G10, TE1, TE3 will be worked on.

EVALUATION

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

• The continuous evaluation of the students (5% 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 reports of practices presented. The average of all these activities represents 70% of the final grade. (G4, G5, G10, TE3)

• The individual theoretical exam (25% of the final grade). (G4, G5, G10, TE3)

Both attendance at the practical sessions and calculations in the laboratory, as well as taking the exam, are compulsory and necessary for passing this module. The realization of the practices is a non-recoverable and compulsory activity for the overcoming of the subject.

Some of the parts of them, will be minimal and therefore it will be necessary for the student to pass them to pass the course:

• The average of the questionnaires prior to the completion of each practice will have to be 5 out of 10. This minimum is a requirement to be able to take the theoretical exam. If the student does not achieve this minimum, they will go directly to the second call where they will have to obtain this minimum prior to the theoretical exam.

• If the student does not obtain a minimum mark of 4 (out of 10) in the exam, the final mark will be the one obtained in the exam.

• If the student does not obtain a minimum mark of 3 (out of 10) in all the reports or a minimum mark of 5 (out of 10) in the average among all the practical reports, the final mark will be the minimum value of the two cases. raised.

It will be necessary for the student to obtain a minimum grade of 5 (out of 10) to pass the course.

• If even exceeding the minimums the student does not achieve the minimum final grade of 5, the student must repeat the exam on the second call, which will be done on the official date, and / or submit the reports with a grade lower than 5. The qualification criteria will be the same.

The exams will have theoretical and practical questions. Achievement of competences G4 , G5 , G10 , TE1 , TE3 will be evaluated.

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)

REFERENCES

Basic

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Additional

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