COURSE DATA

DATA SUBJECT

Code: 34761
Name: Chemical reaction engineering II
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	3	First quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	4	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Chemical reaction engineering	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Cuarto curso	COMPULSORY

COORDINATION

CERISUELO FERRIOLS JOSEP PASQUAL

IZQUIERDO SANCHIS MARTA

SUMMARY

Chemical Reaction Engineering II is a part of the matter of the same name. His general objective is the increase of the knowledge of kinetics of chemical reactions and the combination of this knowledge with the bases of chemical engineering in order to apply them to the design and operation of the reactors of the chemical and biochemical industry.

Chemical reactors are the object of study of the Chemical Reaction Engineering. This study has two slopes, the analysis of the behaviour and the design of the equipment and of its operating. It is a very applied field. With this knowledge one can study the behaviour and the design of different chemical reactors.

The practical part tries of study different applications of the exposed concepts, thus, for example, the necessary volume of the reactor to get a conversion or a production will be calculated, and it will be analysed the effect of modify some parameter, as for example the temperature of operation. The interpretation of results will be an important part of the learning process.

It is a compulsory subject that is imparted in the first semester of the third year of the Chemical Engineering degree. It has assigned 6 ECTS credits.

With this subject of study we tries to give an overview of the Chemical Reaction Engineering and to provide the students the necessary knowledge of the basics of the processes of chemical reaction, introducing the necessary tools for analysis and design of chemical reactors. These tools will be the combination of balances with the rate equations. This way, it will be established the essential bases in order to a successfully application.

Once the items will be introduced they will be used in order to solve a series of problems. Students will practice with these concepts and procedures in other subject.

The **content** of this subject is: Non-isothermal reactors. Non-ideal reactors. Heterogeneous reactors. Catalytic reactors. Safety and chemical reactors.

Remarks: Theory classes will be given in **Valencian**, while practical classes will be as detailed in the course teaching guide published in the website of this 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

It would be convenient to have the following prior knowledge:

- To have taken the subject Chemical Reaction Engineering I.
- Differential and integral calculus, solution of systems of equations (algebraic and differential), numerical methods, optimization, coordinate systems.
- Stoichiometry, kinetics.
- Equilibrium and heat of reaction.
- Mass and energy balances, heat and matter transfer, fluid mechanics.

COMPETENCES / LEARNING OUTCOMES

1401 - Degree in Chemical Engineering

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.

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

Analyse, design, simulate and optimise processes and products.

Be able to understand and apply the legislation required for the practice of the profession of technical industrial engineer.

Propose creative and innovative solutions to complex situations or problems, typical of the area of ¿¿¿¿connection, to donate responses to the various professional and social needs

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.

Work in a multilingual and multidisciplinary environment.

DESCRIPTION OF CONTENTS

1. Ideal reactors. Non-isothermal reactors.

The continuous stirred tank reactor (CSTR). The batch reactor. The plug flow reactor (PFR). Semicontinuous reactor. Series of reactors.

2. Stability of the chemical reactor behaviour.

Steady state multiplicity. Control and security problems in the chemical reactors.

3. Non-ideal flow in chemical reactors.

The distribution of residence times function (RTD). Reactor modelling with the RTD. Conversion levels in non-ideal reactors.

4. Heterogeneous reactors.

Transport processes in solid-fluid heterogeneous reactions. Models for solid-fluid reactions. Determination of limiting step.

5. Catalytic reactors.

Catalytic reactions kinetic. Design application.

6. Safety and chemical reactors.

Explosions. Overpressure. Design of safer reactors.

7. Non-conventional reactors

CVD reactors. Membrane reactors. Supercritical reactors.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	25,00
Classroom practices	35,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	10,00
Preparation of lessons	29,00
Preparation for assessment activities	51,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

To successfully develop the subject, different strategies must be followed: theoretical lessons and solving-problem lessons, autonomous work and participation in tutorials.

Classroom lessons.

In these classes the theoretical contents of the subject are taught and problems are solved according to the needs of each moment. In the first place, the theoretical contents are presented in a participatory master class format, pointing out the texts in which the subject can be found, promoting autonomous work,

to later solve a series of standard problems by lecturers in practical classes, so that students learn to identify the essential elements of solving the problem. The materials used in the theoretical classes and the collection of problems (with class problems and to be solved at home) will be shared through the Virtual Classroom.

Throughout the semester, the resolution and delivery of various problems individually or in small groups is also proposed for correction and qualification, and this qualification will be part of the final evaluation of the subject.

Autonomous study and work.

The students will have to study on their own, to assimilate the exposed knowledge, and practice them with the proposed problems. Some of the proposed problems will not be solved in class so that students can prepare them and solve doubts attending the tutorial sessions.

Tutorials.

Students will be able to consult the lecturers either directly in class or by attending the tutorials at the established time or through the Virtual Classroom tutoring forum.

EVALUATION

The assessment of student learning will be based on the activities of the course (questionnaires and problems delivered) and the examination(s).

Regarding the examination(s), students can choose one of the following options **in the first call**:

(1) Single final examination on an official date where the entire content of the course will be evaluated.

(2) Partial examination on a date indicated at the beginning of the course and a second partial examination on an official date. Thus, the overall mark of the examinations will be calculated as the weighted average of the two partial examinations.

In the second call, the examination will be based only on option (1), that is, a single final examination in the official date where the entire content of the course will be evaluated.

The **final grade will be obtained as the highest of:**

- The weighting between the average mark of the questionnaires (15%), problems delivered (15%) and the mark of the exam(s) (70%), or
- The mark of the knowledge exam(s) plus 5% of the weighted average mark of the activities (questionnaires and problems delivered).

If the examination mark is less than 4.5 out of 10, the final mark will be the one obtained in the examination.

The course will be considered as passed when the mark obtained is equal to or greater than 5 out of 10.

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 will be governed by the one established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters (ACGUV 108/2017)

REFERENCES

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- CUTLIP, M.B. i SHACHAM, M. Problem solving in Chemical Engineering with numerical methods Prentice Hall 1999.
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