COURSE DATA

DATA SUBJECT

Code: 34760
Name: Chemical reaction engineering I
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	2	Second quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	3	Second quarter

SUBJECT-MATTER

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

COORDINATION

CHAFER ORTEGA AMPARO

SUMMARY

Chemical Reaction Engineering I 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. It is a compulsory subject that is imparted in the second semester of the second 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: Kinetics of chemical reactions. Ideal reactors. Basic equations of design.

Design of ideal reactors. Biochemical reactors, polymerization reactors, membrane reactors. Basis of Biochemical Engineering.

The theory classes will be taught in Valencian and the practical sessions as stated in the assignment form on the web 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

These previous concepts were recomended:

Differential and integral calculation, systems of equations solution (algebraic and differentials), numerical calculation, optimization, statistics, coordinate systems.
Stoichiometry, kinetics.
Equilibrium and heat of reaction, transmission of heat.
Change of units, Mass, energy and momentum balances, mass and heat transfer, mechanics of fluids.
Software: Basic programs, programs to solve systems of equations .

COMPETENCES / LEARNING OUTCOMES

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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.

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. INTRODUCTION AND GENERAL CONCEPTS.

Chemical engineering and chemical reactors engineering. Chemical reactions and kind of reactors. Examples.

2. PHENOMENOLOGY OF CHEMICAL REACTIONS.

Stoichiometry. Chemical schemes simple, global, multiples. Composition measures. Static and dynamic systems. Simple and multiple reactions. Measures of the progress of the reaction, selectivity, etc. Chemical equilibrium. Chemical Kinetics.

3. IDEAL REACTORS. ISOTHERMAL BEHAVIOR.

Introduction to design of chemical reactors. The Continuous Stirred Tank Reactor (CSTR). The discontinuous stirred tank reactor (batch). Semicontinuous reactors. The continuous tubular or plug flow reactor (PFR). Abstract of design equations on Ideal Reactors. Changing heat systems for isotherm behaviour.

4. SELECCTION AND EXTENSIONS OF REACTORS

Introduction. Reactors of plug flow (RFP) with recirculation. Combination of reactors: graphic o analytical procedures of design. Selection of best design alternative: simple reactor or combination .

5. MULTIPLE REACTIONS.

Introduction. Qualitative and quantitative analysis of different systems. Optimization. Polymerization Reactors.

6. BIOCHEMICAL REACTORS.

Introduction to biochemical engineering. Enzyme and microbial kinetics. Design of biochemical 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	25,00
Preparation of lessons	45,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

1 .- Lessons in the classroom. These lectures will be of theory or problems according to the needs of the moment. Thus, first it will be presented the theory and then the practical applications. The model used is as follows: the theory will be exposed briefly by the teacher.

Practical classes of problems will be developed following two models. In some of the lectures the teacher will solve a series of sample problems for to identify the essential elements of the approach and problem resolution. In other kinds of problems will follow a participatory model following a seminar methodology, students will solve problems individually or arranged in groups (cooperative learning), under the supervision of the teacher. After the work, the problems will be collected, analysed and corrected by the teacher or the students themselves.

2 .- Seminars.

Students solve problems in group, using sometimes informatic tools.

EVALUATION

The final grade will have two contributions, the first one (70 %) corresponds to the exam , the second one (30 %) will be related to continuous evaluation with activities in the classroom along the course (20 %) and with the student resolution of test at virtual classroom (10 %). If the continuous evaluation goes down the student qualification, the mark will be calculated only with the results of exam.

The exam will consist of theory (questions) and problems, for answer the theory the students can dispose of a form (one sheet), and for the problems solution they can use books, notes..., but without solved problems.

Examination and activities will be scored over 10 points; to pass the subject should at least get 4.5 points in the exam and 5.0 in the final grade.

The only recoverable activity is the examination, in the second call

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).

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" (ACGUV 108/2017).

REFERENCES

- BERNA. A., CHÁFER, A. i ROSSELLÓ, C. "Enginyeria dels Reactors Químics. Problemes i qüestions". Universitat de València. 2009. ebook en UV

- ESCARDINO, A. i BERNA. A. "Introducció a l'Enginyeria dels Reactors Químics". Universitat de València, 2003. ebook en UV

- FOGLER, H. S. "Elements of Chemical Reaction Engineering", 3rd ed., Prentice Hall. New Jersey, 1999. Hi ha una edició en castellà: "Elementos de Ingeniería de las Reaccciones Químicas" Prenctice Hall, México 2001.

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

- LEVENSPIEL, O. "The Chemical Reactor Omnibook". Ed. Oregón State University. 1993. Traduït per Editorial Reverté. Barcelona. 1986

- SANTAMARÍA, J.M.; HERGUIDO, J.; MENÉNDEZ, M.Á. i MONZÓN, A. "Ingeniería de reactores", Síntesis, Madrid 1999.