

<b>Centre</b>	<b>University College of Engineering of Vitoria-Gasteiz</b>
<b>Name of subject</b>	<b>26092 – Chemical Reaction Engineering</b>
<b>Qualification</b>	<b>Degree in Industrial Chemical Engineering</b>
<b>Type</b>	<b>Compulsory</b>
<b>Credits</b>	<b>6 ECTS</b>
<b>Year</b>	<b>3</b>
<b>Term(s)</b>	<b>1st</b>
<b>Department</b>	<b>Chemical and Environmental Engineering</b>
<b>Language</b>	<b>Spanish</b>

## Outcomes / Objectives

### OUTCOMES

Acquire knowledge in chemical reaction engineering and reactor design (included in TEQ1).

Apply the strategies of scientific methodology, analyse the problem situation qualitatively and quantitatively; propose hypotheses and solutions to solve chemical reaction engineering problems (included in TEQ8).

Use specific vocabulary and terminology to effectively communicate knowledge, procedures and results in the field of chemical reaction engineering and reactor analysis and design (included in TEQ9).

Work efficiently in multidisciplinary environments integrating capabilities and knowledge to make decisions in the field of chemical reaction engineering (included in TEQ10).

### BRIEF DESCRIPTION.

Chemical kinetics applied to reactor analysis and design.

Single phase reactors: Ideal reactors and deviations from ideal reactor behaviour.

Multiphase reactors: fluid-solid, fluid-fluid.

### OBJECTIVES.

Have knowledge of the main aspects of formal chemical kinetics and its application to the analysis and design of chemical reactors.

Have knowledge of the fundamentals of reactor modelling and its application to single phase and multiphase reactive systems.

Have knowledge of and apply numerical methods to the solution of descriptive reactor models.

## Syllabus

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### THEMATIC BLOCK I: APPLIED CHEMICAL KINETICS

UNIT 1. FUNDAMENTAL CONCEPTS OF CHEMICAL REACTION ENGINEERING.

UNIT 2. DETERMINATION OF THE REACTION RATE.

UNIT 3. KINETIC BEHAVIOURS OF INTEREST IN CHEMICAL ENGINEERING.

UNIT 4. KINETIC CHEMICAL CONSIDERATIONS FOR GAS PHASE REACTIVE SYSTEMS.

### THEMATIC BLOCK II: INTRODUCTION TO THE STUDY OF CHEMICAL REACTORS.- IDEAL REACTORS

UNIT 5. INTRODUCTION TO THE STUDY OF CHEMICAL REACTORS.

UNIT 6. THE PERFECTLY MIXED BATCH REACTOR.

UNIT 7. THE PERFECTLY MIXED CONTINUOUS REACTOR.

UNIT 8. THE PLUG FLOW REACTOR.

UNIT 9. TUBULAR REACTORS. VARIATIONS OF THE PLUG FLOW.

UNIT 10. COMPARATIVE STUDY OF PERFECTLY MIXED AND PLUG FLOW REACTORS. SERIES OF PERFECTLY MIXED REACTORS.

UNIT 11. REACTOR DESIGN CONSIDERATIONS FOR COMPLEX REACTIONS.

THEMATIC BLOCK III: DEVIATION FROM IDEAL BEHAVIOUR.

UNIT 12. INTRODUCTION TO THE STUDY OF NON-IDEAL FLOW REACTORS I. RESIDENCE TIME DISTRIBUTION.

UNIT 13. MODELLING OF REAL REACTORS.

THEMATIC BLOCK IV: MULTIPHASE REACTORS.

UNIT 14. THE FIXED BED REACTOR

UNIT 15. THE FLUIDISED BED REACTOR

UNIT 16. GAS-LIQUID AND LIQUID-LIQUID REACTORS

## Methodology

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### Teaching Method

Face-to-Face Teaching Hours									
Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice	
45		15							
Student Hours of Non Face-To-Face Activities									
Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice	
68		22							

## Assessment System

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### General criteria

- Written essay exam
- Practical tasks (exercises, case studies or problems)
- Individual assignments
- Group assignments

### Clarification regarding assessment

- Exam score: 90%
- Compulsory deliverables: 10%
- Optional deliverables: additional 0-10%

## Bibliography

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### Basic Bibliography

- Ingeniería de las Reacciones Químicas. Levenspiel, O., Ed. Reverté, Barcelona, 1990.
- Ingeniería de Reactores. Santamaría, J. M.; Herguido, J.; Menéndez, M. A. y Monzón, A. Ed. Síntesis, Madrid 1999.

### In-depth Bibliography

- Chemical Reactor Design, Optimization, and Scaleup. Nauman, E. B. Wiley second edition New Jersey 2008.
- El Omnidisco de los Reactores Químicos. Levenspiel, O. Ed. Reverté, Barcelona, 1986.
- Elements of Chemical Reaction Engineering. Fogler, H. S., Ed. Prentice Hall, New Jersey 1999.
- Chemical Reactors, Design, Engineering, Operation. Trambouze, P.; Van Landehem, H.; Wauquier, J. P. Ed. Technip, 1984.
- Chemical Reactor. Analysis and Design. Froment, G. F. and Bischoff, K. B. John Wiley and Sons. New York, 1979.

### Magazines

- Chemical Engineering Journal. Publisher. ELSEVIER SCIENCE
- Chemical Engineering Science. Publisher. PERGAMON-ELSEVIER  
(Both included in ScienceDirect)