

## SUBJECT TEACHING GUIDE

G1632 - The advanced chemical reactor engineering

Degree in Chemical Engineering

Academic year 2019-2020

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering			Type and Year	Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	SUBJECT OPTION C: GUIDANCE IN ADVANCED CHEMICAL ENGINEERING Optional Module				
Course unit title and code	G1632 - The advanced chemical reactor engineering				
Number of ECTS credits allocated	6	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIAS QUIMICA Y BIOMOLECULAR				
Name of lecturer	ALFREDO ORTIZ SAINZ DE AJA				
E-mail	alfredo.ortizsainz@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO (S3035F)				
Other lecturers	EUGENIO DANIEL GORRI CIRELLA				

### 3.1 LEARNING OUTCOMES

- 1. Know how to select the most suitable type of chemical reactor for a particular process.
2. Develop models of homogeneous and heterogeneous reactors based on mass, energy and momentum balances, as well as the type of flow and contact between the phases.
3. Be able to design chemical reactors determining the most appropriate shape and size. Determine the sensitivity to a variation of the operating parameters and therefore its stability, optimum operating conditions and control.
4. Know how to characterize the actual flow in the reactor and conveniently consider it in its design.

#### 4. OBJECTIVES

The course is aimed at choosing the right type of chemical reactor for a given reaction process, the sizing of the reactor, the determination of optimum operating conditions and their behavior when changes in the values of the operation variables occur.

Develop and resolve property balances, material, thermal energy and momentum in homogeneous and heterogeneous reactors.

#### 6. COURSE ORGANIZATION

##### CONTENTS

1	BLOCK1: Review of Chemical Kinetics concepts a) Homogeneous reactions. b) Heterogeneous catalytic reactions. c) Non-catalytic heterogeneous reactions. The role of mass transport in the overall rate of the process. d) Tools for data analysis and estimation of kinetic parameters.
2	BLOCK 2: Study of the optimal operating conditions of multiple units systems. Case of studies. Cascade reactors with recycle streams.
3	BLOCK 3: Analysis and design of heterogeneous reactors a) Fixed bed reactors - pseudo-homogeneous and heterogeneous models. b) Fluidized bed reactors - design models. c) Reactors for reactions G-L, L-L and G-L-S. d) Cases of representative study of the chemical and petrochemical industry
4	BLOCK 4: Reactors for process intensification. Microreactors. Membrane reactors. Hybrid systems for separation and reaction: reactive distillation.

#### 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Minimum score of 3.5 It will take place in week 14 or 15 Second-chance examination will be at the final exam on the scheduled dates for the ETSIIyT.	Written exam	No	Yes	30,00
It will require a portfolio that integrates each of the activities scheduled throughout the course consistent in supervised works and problems.	Others	No	No	40,00
Minimum score of 3.5 Consist of different presentations that develop during the course	Oral Exam	No	Yes	30,00
<b>TOTAL</b>				<b>100,00</b>

##### Observations

Continuous evaluation is based on the realization of one written test, oral presentations and delivery of a portfolio with all tasks proposed during the teaching period of the course. To access the continuous evaluation subject, the student must have attended 80% of classes.

Students who fail the course through continuous evaluation have the option to take the final exam of the course on the dates indicated in the ETSIIyT (minimum grade 5.0)

Observations for part-time students

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

### BASIC

- O. Levenspiel, Ingeniería de las Reacciones Química, Limusa Wiley (2004).
- G. F. Froment, K. B. Bischoff, J. De Wilde, Chemical Reactor Analysis and Design, John Wiley (2011).
- S. H. Fogler. Elementos de ingeniería de las reacciones químicas, 4ª ed., Pearson Educación, México, 2008.
- C. Hill, T. Root, An Introduction to Chemical Engineering Kinetics & Reactor Design, John Wiley, 2014.
- H. Rase, Chemical Reactor Design for Process Plants, Wiley, 1977.