

SUBJECT TEACHING GUIDE

G789 - Catalysis Engineering

Degree in Chemical Engineering First Degree in Chemical Engineering

Academic year 2024-2025

1. IDENTIFYING DATA					
Degree	Degree in Chemical Engineering First Degree in Chemical Engineering			Type and Year	Optional. Year 4 Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Option A: Fundamental Chemical Engineering Optional Module				
Course unit title and code	G789 - Catalysis 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. DE QUIMICA E INGENIERIA DE PROCESOS Y RECURSOS.				
Name of lecturer	FERNANDO GONZALEZ MARTINEZ				
E-mail	fernando.gonzalez@unican.es				
Office	E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 3. DESPACHO (S3092)				
Other lecturers	ROSA MARTIN RODRIGUEZ MARINA GONZALEZ BARRIUSO				

3.1 LEARNING OUTCOMES	
- The student must know the vocabulary of the catalysis, the fundamentals and applications of homogeneous and heterogeneous catalysis and the main catalytic process.	
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- The student must know the fundamentals of the reactivity of chemical compounds and differentiate the types of reactions.	
- The student must know the main catalytic process	

4. OBJECTIVES

The student must explain the characteristics of an homogeneous catalyst and an heterogeneous one and how is their action.

Describe a catalytic process and know the principles of activity and selectivity.

The student must know the principal industrial catalytic process, its limitations and continuous improvement.

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The student must apply the acquired knowledge to understand the development of new process.

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6. SUBJECT PROGRAM

CONTENTS

1	Evolution of homogeneous catalysis. Development of organometallic chemistry and homogeneous catalysis, challenges. Activity and selectivity. Catalyst cycle. Kinetics. Hydrogenation. Hydrogen transfer. Asymmetric hydrogenation. L-Dopa synthesis. Metathesis. Ring-Opening Metathesis Polymerization. Carbonylation. Methanol carbonylation to obtain acetic acid. Acetic anhydride production. Coproduction of the acid and the anhydride. Hydroformylation.
2	3. CATALYSIS WITH NANOPARTICLES Nanomaterials for catalysis Synthesis and characterization techniques of catalysts Carbon monoxide oxidation by gold nanoparticles Photocatalysis with TiO ₂ nanoparticles. Synthesis of nanoparticles-based catalysts.
3	Heterogeneous catalysis. Introduction and kinetics. Gas/solid systems. Active Centers. Models. Catalyst preparation and surface characterization. Temperature Programmed techniques (TPD, DSC), spectroscopy, microscopy (TEM, SEM). Green Chemistry. Industrial catalyst process. Petrochemical industry. Ammonia Catalysis.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
continuous evaluation 50%	Work	No	No	50,00
written exam 50%	Written exam	No	Yes	25,00
Part-time students will be able to carry out a final evaluation of the entire subject (50%) and prepare two works, one for each block of the subject.	Written exam	No	Yes	25,00
TOTAL				100,00
Observations				
Observations for part-time students				
Part-time students may make a final assessment of the whole subject, (50%) and the development of two jobs, one for each block				

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Fundamentos y aplicaciones de la Catálisis Homogénea. Luis A. Oro y E. Sola Eds. INO Reproducciones S.A., 2000.

Catalysis. Concepts and Green Applications. Gadi Rothenberg. Ed. Wiley VCH, 2008.

"Nanoparticles and Catalysis" ,D. Astruc, Wiley-VCH, 2008.