SUBJECT TEACHING GUIDE

G789 - Catalysis 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 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

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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6. COURSE ORGANIZATION	
CONTENTS	
1	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.
2	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 anydride. Hydroformylation.
3	3. CATALYSIS WITH NANOPARTICLES Nanomaterials for catalysis Synthesis and characterization techniques of catalysts Carbon monoxide oxidation by gold nanoparticles Photocatalysis with TiO2 nanoparticles. Synthesis of nanoparticles-based catalysts.

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	50,00
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.