Universidad Zaragoza

Academic Year/course: 2023/24

29940 - Catalysis and Catalytic Processes of Industrial Interest

Syllabus Information

Academic year: 2023/24
Subject: 29940 - Catalysis and Catalytic Processes of Industrial Interest
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 435 - Bachelor's Degree in Chemical Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject type: Optional
Module:

1. General information

The goal of this subject is that students acquire the **fundamental concepts of catalysis** and learn about the most relevant catalytic systems from an industrial perspective. In addition, students will learn how to carry out catalytic reactions in the laboratory and **acquire basic tools to contribute to the sustainability of the chemical industry**, allowing for more efficientproduction.

In summary, the purpose of this subject is to provide students with **theoretical and practical knowledge** that will enable them to be more competent **in the field of catalysis and its application in the chemical industry**.

These approaches and goals are aligned with some of the**Sustainable Development Goals** (SDGs) of the 2030 Agenda (http://www.un.org/sustainabledevelopment/es/) and certain targets, specifically: Goal 7, Objective 7.2 and 7.3; Goal 8, Objective 8.4 and Goal 9, Objective 9.4.

2. Learning results

- It will allow the student to know and analyze the most important catalytic processes at present and new trends in order to satisfactorily carry out theirprofessional activity.
- Design, develop and optimise new catalysts, key to the development of a sustainable chemical industry, necessary for compliance with the environmental laws set out by international organisations.
- Analyze, present and communicate results of catalytic processes.

3. Syllabus

Homogeneous Catalysis:

- **Unit 1.** Introduction: Atomic economy, selectivity and types of catalysis.
- **Unit 2.** Characteristics of homogeneous catalysts.
- **Unit 3.** Fundamental reactions and reaction mechanisms.
- **Unit 4.** Hydrogenation: Wilkinson catalyst, asymmetric hydrogenation.
- **Unit 5.** Carbonylation: Acetic acid synthesis and hydroformylation.
- **Unit 6.** Polymerization. Ziegler-Natta catalysts and metallocenes.

Heterogeneous Catalysis:

- **Unit 1.** Introduction to heterogeneous catalysis.
- **Unit 2.** Catalyst structure.
- **Unit 3.** Preparation of catalysts.
- **Unit 4.** Characterization of catalysts.
- **Unit 5.** Deactivation.
- **Unit 6.** Heterogeneous catalysis in the chemical industry.

4. Academic activities

- Participative **lectures** on theory and model problems (40 h).
- **Problem** solving classes **and case studies** (6 h).
- **Laboratory practice** (14 h).
- Teaching **assignments** (15 h), individual or in groups. Teaching assignments and practices reportsare included.
- **Individual study** (71 h).
- **Final** assessment(4 h). There will be a global test where the theoretical and practical knowledgewill be assessed.
- **Tutoring.** Students will have 6 hours per week for individualized tutoring or group tutoring.

5. Assessment system

The homogeneous and heterogeneous catalysis part will be assessed separately.

The final grade will be the average of the two parts, being necessary a grade higher than 5 in each of them.

Option 1:

Homogeneous Catalysis:

1. Completion of the **problems and questions** proposed during the development of the subject, **C (40%)**.

2. Completion and report of **laboratory practicals**, **P (20%)**.

3. **Oral presentation** of a tutored paper **PO (40%)**.

Note Homogeneous part = 0.4 x **C** + 0.2 x **P** + 0.4 x **PO**.

Heterogeneous Catalysis:

1. Completion of the **problems and practical cases** proposed during the development of the subject, **C (40%)**.

2. Completion of **laboratory practicals**, **P (20%)**.

3. Completion of a **final test**, **E (40%)**. It will consist of theoretical-practical questions reasoned in which the application of theory to concrete cases and problem solvingwill be requested.

Note Heterogeneous part = 0.4 x **C** + 0.2 x **P** + 0.4 x **E**.

Option 2:

Students will also be able to opt for a **global evaluation**, both in the **1st and 2nd call (100%** of the **final grade**), which will consist of questions and problems of the two differentiated blocks, similar to those of similar characteristics to the activities carried out during the term in the development of the subject