

Academic Year/course: 2021/22

29940 - Catalysis and Catalytic Processes of Industrial Interest

Syllabus Information

Academic Year: 2021/22

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

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process that is designed for this subject is based on the following: The learning process will take place at several levels:

The methodology followed in this course is oriented towards the achievement of the learning objectives. It favors the understanding of the different chemical processes that occur in the environment. A wide range of teaching and learning tasks are implemented, such as theory sessions, laboratory sessions and assignments. Students are expected to participate actively in the class throughout the semester. Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials, including a discussion forum. Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

The program that the student is offered to help you achieve the expected results includes the following activities

? **Lectures** (4.6 ECTS: 46 hours). Lecture notes and a set of problems (and their corresponding solutions) will be available for the students. At the end of each topic, some of the problems will be solved in a class by the teacher and the rest will be done individually. The lecturer will also assign, from those unsolved problems, which they will submit to the teacher.

? **Laboratory sessions** (1.4 ECTS: 14 hours). ~~Two~~ The sessions of 4 an 3 hours that take place at the beginnings of March in ~~lab~~ Inorganic Chemistry and Chemical & Environmental Engineering Labs of EINA (~~Building Torres Quevedo~~). Students are provided in advance with task guidelines for each session.

? **Assignments** (1.5 ECTS: 15 hours). In small groups or in pairs students work on lab reports and different assignments during the course.

? **Autonomous work** (7.1 ECTS: 71 hours). Autonomous work and study.

? **Assessment** (0.4 ECTS: 4 hours). Problem-solving questions/practical part with notes of classes.

4.3. Syllabus

Homogeneous Catalysis

Unit 1.- Introduction to catalysis: Basic Concepts. Atomic economy. Selectivity. Types of catalysis. (6 h, theory + problems).

Unit 2.- Homogeneous catalysis: Characteristics of catalysts. Fundamental reactions and reaction mechanisms: Reactions dissociation and coordination, reactions of oxidative addition and reductive elimination, insertion and β -elimination reactions, and reactions of nucleophilic attack on coordinated ligands. (10 h, theory + problems).

Unit 3.- Hydrogenation. Wilkinson's catalyst. Asymmetric Hydrogenation. Hydrogenation transfer. (10 h, theory + problems + practice).

Unit 5.- Carbonylation: synthesis of acetic acid. Hydroformylation. (2 h, theory + problems).

Unit 6.- Polymerization. Ziegler-Natta catalysts and metallocenes. (2 h, theory + problems).

Heterogeneous Catalysis

Unit 6.- Heterogeneous Catalysis: Differences between homogeneous and heterogeneous catalysis. Stages in the catalytic reaction. Catalyst performance diagnosis. (17 h, 10 theory + problems) + 7 h practice.

Unit 7.- Structure of catalyst: design. Active components. Supports. Promoters. Examples. (3 h, theory + problems)

Unit 8.- Preparation of catalysts: impregnation, precipitation, Exchange. Conformed. (2 h, theory + problems).

Unit 9.- Characterization of catalysts: Material properties. Particle properties. Surface properties. Activity. (2 h, theory + problems).

Unit 10.- Deactivation: Concept. Soiling. Poisoning. Sintering. Other causes. Kinetics. Regeneration. (2 h, theory + problems).

Unit 11.- Heterogeneous catalysis in the industry : Inorganic base, oil refining, processing coal, and natural gas. Catalytic reactors. (3 h, theory + problems).

4.4. Course planning and calendar

Schedule sessions and presentation of works

Further information concerning the timetable, classes, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the "Escuela de Ingeniería y Arquitectura" website and the Bachelor's Degree in Chemical Engineering website (<https://eina.unizar.es>).

4.5. Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=29940&year=2019