

Academic Year/course: 2021/22

## 30027 - Industrial Chemical Processes

### Syllabus Information

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**Academic Year:** 2021/22

**Subject:** 30027 - Procesos químicos industriales

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 330 - Complementos de formación Máster/Doctorado  
436 - Bachelor's Degree in Industrial Engineering Technology

**ECTS:** 6.0

**Year:** 436 - Bachelor's Degree in Industrial Engineering Technology: 3  
330 - Complementos de formación Máster/Doctorado: XX

**Semester:** Second semester

**Subject Type:** 436 - Compulsory

330 - ENG/Complementos de Formación

**Module:**

## 1. General information

## 2. Learning goals

## 3. Assessment (1st and 2nd call)

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

*Warning:* The availability of this information in english does not imply that any class, course material or activity will be carried out/available in english. The language of the course is SPANISH. The student must be able to understand and communicate adequately in spanish.

This subject has the purpose of a total analysis of the industrial chemical processes through mass and energy balances. For the student it is also important the knowledge of specific and usual components in these processes. Moreover, the students learn the key aspects of some selected processes such as air separation and sulfuric acid production, among others.

With the purpose that the students achieve this knowledge a learning process is suggested with lectures and activities in small class (around 20 students) to analyze case studies and the resolution of problems by themselves. The learning process of the student is developed from the lectures, guided by the teacher, who also solves and explains model problems. Afterwards, in small group problem classes the participation of the student is higher. The work in small groups also favours the interaction between students helping to the achievement of competences. A further step is given during the autonomous work of the student when solving a set of problems of mass and energy balances. The fulfillment of the case study of more complexity (Project), carried out in small groups, allows the students to face a real case, promoting competences of information search about a specific process, data selection to carry out the balances, and also the consideration of environmental issues of the

process. The students also learn written information with an appropriate format that will be useful later in their TFG (Bachelor's Degree Final Work). The students also present the Project orally to the teacher, which strengthens them in this communication ability.

#### 4.2. Learning tasks

The course includes 6 ECTS organized according to:

- Lectures (1.6 ECTS): 40 hours.
- Small group sessions (3h/week every 2 weeks) (0.8 ECTS): 20 hours.
- Autonomous work, individually and in a group for assignments (0.4 ECTS): 10 hours.
- Autonomous work, in group for the case study (1.2 ECTS): 30 hours.
- Evaluation and personal study (2 ECTS): 50 hours.

In order to achieve the results, the following activities are carried out:

- Study of concepts and procedures for the transformation of raw materials and resources.
- Problem-solving of mass and energy balances of chemical processes.

These activities are developed as follows:

1. Lectures, explained to the whole group, with the basic concepts of the course. The participation of the student is emphasized by questions during the class.
2. Small group activities. These activities are carried out in groups of 20 students. Active learning methodologies such as problem-solving and others can be used. The student faces problem-solving with the aid of the lecturer.

Examples of industrial chemical plants will be used to gain deep in chemical processes carried out at industry around the world and to complement theory and problem classes.

Besides, the groups (3 students maximum) must solve (out of class) a case study of higher complexity (Project), searching the information required for describing and specifying the process suggested by the lecturer and solving the mass and energy balances.

Additionally, the work in groups helps the students to learn cooperative working, promoting communication and interpersonal skills, divergent thinking and learning styles. The use of groups can result in higher motivation, knowledge retention and academic success.

3. Autonomous work, studying the course and applying it to exercise solving. This activity is basic in the learning process and for overcoming evaluation activities. A set of problems will be given to the student for solving them.

4. Individual and group tutorials, with more personal work, more adaptive to the specific circumstances of the student, is the most adequate to support the autonomous work of the student. Besides, the case study carried out in a group requires to follow and guide closely during its development.

#### 4.3. Syllabus

The course will address the following topics:

Theory sessions:

- 1.- Introduction. Outstanding and distinguishing characteristics of the Chemical Industry.
- 2.- Basic knowledge on chemical reactors and unit operations.
- 3.- Mass and energy balances in chemical processes.
- 4.- Processes without reaction. Air separation by distillation (cryogenics), adsorption and membranes.
- 5.- Processes with reaction: sulfuric acid production.
- 6.- Power generation: coal combustion, gasification, biofuels and fuel cells. Graphene.
- 7.- Processes in the Oil Refinery.
- 8.- Polymerization Processes

3h sessions (Small group activities):

Session 1. Information searching. Flow diagrams.

Session 2. Mass balances.

Session 3. Mass and energy balances.

Session 4. Energy balances with chemical reaction.

Session 5. Casestudy of a chemical industrial plant.

Session 6. Biomass as a fuel.

#### **4.4. Course planning and calendar**

For further details concerning the timetable, classroom and further information regarding this course, please refer to the Escuela de Ingeniería y Arquitectura de la Universidad de Zaragoza, EINA, web (<https://eina.unizar.es/>). For the group activity (case study), at least two meetings are mandatory, first one around april 10<sup>th</sup> for orientative issues, and a final one around may 20<sup>th</sup> for results delivery. Each lecturer will inform about his/her schedule.

#### **4.5. Bibliography and recommended resources**

Link:

[http://biblos.unizar.es/br/br\\_citas.php?codigo=30027&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=30027&year=2019)