

## 29933 - Environmental engineering

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 29933 - Environmental engineering

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

**Degree:** 435 - Bachelor's Degree in Chemical Engineering

**ECTS:** 6.0

**Year:** 4

**Semester:** First semester

**Subject Type:** Compulsory

**Module:** ---

### 1.General information

#### 1.1.Aims of the course

#### 1.2.Context and importance of this course in the degree

#### 1.3.Recommendations to take this course

### 2.Learning goals

#### 2.1.Competences

#### 2.2.Learning goals

#### 2.3.Importance of learning goals

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

#### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

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

#### 4.1.Methodological overview

This subject includes theory and practice and its learning process is based on 2.4 ECTS of work done in-person (60 hours) and 3.6 ECTS (90 hours) of self-guided study. The programmed activities are detailed below.

The class presentations and laboratory instructions are available for the students at the subject website (Moodle platform) that can be found at <http://moodle2.unizar.es/add/>

#### 4.2.Learning tasks

**The course includes the following learning tasks:**

**On-site activities: 2.4 ECTS, 60 hours**

1. Classroom-based sessions (TP1): 30 hours, 2 per week. Sessions with theoretical and practical contents. The units are presented encouraging class participation, reflexive and proactive attitudes.
2. Problem-solving and case studies (TP2): 15 hours, 1 per week. Some exercises and case studies will be done in order to complement theoretical sessions. Additionally, some of these sessions will be used to control the work that the student will prepare related to a global strategy for the pollution control in an industrial process. The student should work on the preparation of these case studies previously, and participate in class.
3. Laboratory and simulation sessions (TP3): 10 hours divided into 5 sessions of 2 hours each. The student will develop practical skills related to pollution control processes, either based on simulation software or in laboratory

work. The student should read the instructions for each session previously and be able to hand in the required report at the end of each session.

4. Evaluation (TP8): 5 hours. Besides obtaining a mark, evaluation is one of the steps of the learning process, where the students can check their degree of understanding of the presented concepts and their acquirement of the required competencies.
5. If possible, some visits to environmental facilities will be planned during the semester. These visits are voluntary for the students. Attendance will account for approximately 5 hours of on-site activities.

**Off-site activities: 3.6 ECTS, 90 hours.**

1. Study (TP7): **80** hours. Includes study and problem-solving. Continuous work by the student will be encouraged. Tutorials are also included in this section.
2. Teaching work (TP6): This task will consist in the elaboration of a supervised group work.

### 4.3.Syllabus

The course will address the following topics:

- Topic 0. Introduction. Present environmental issues. The 2030 Agenda for Sustainable Development and Sustainable Development Goals (SDGs)

#### Section 1. Water pollution

- Topic 1. Water cycle.
- Topic 2. Types of water pollutants.
- Topic 3. Physical processes/operations in water treatment.
- Topic 4. Biological processes/operations in water treatment.
- Topic 5. Chemical processes/operations in water treatment.
- Topic 6. Water treatment facilities.

#### Section 2. Air pollution

- Topic 1. The atmosphere and its pollution problems.
- Topic 2. Types of air pollutants: Primary pollutants
- Topic 3. Types of air pollutants: Secondary pollutants
- Topic 4. Particle collection systems.
- Topic 5. Pollutant control systems.

#### Section 3. Residues

- Topic 1. Introduction.
- Topic 2. Residues management and control
- Topic 3. Recycling.
- Topic 4. Biological treatments for residues.
- Topic 5. Thermal treatment for residues.
- Topic 6. Landfills.

#### Section 4. Integrated Environmental management tools

- Topic 1. Integrated environmental authorization
- Topic 2. Environmental impact assessment

#### Laboratory sessions

- Lab session 1: Industrial wastewater treatment by physical/chemical processes.
- Lab session 2: Use of software tools for the simulation and design of wastewater treatment facilities.
- Lab session 3: Use of software tools for the simulation and design of gas pollution control facilities.
- Lab session 4: Stabilization of residues containing dangerous substances.
- Lab session 5: Use of software tools for the management of residues containing dangerous substances.

### 4.4.Course planning and calendar

Classroom-based sessions (TP1). 30 hours total (2 per week).

Problem-solving and case studies (TP2). 15 hours total (1 per week).

Laboratory and computer sessions (TP3). 10 hours total (5 sessions, 2 hours each).

Evaluation (TP8): 5 hours total.

Home study (TP7):80 hours estimated.

Group work (TP6): 10 hours of autonomous work.

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

[http://biblos.unizar.es/br/br\\_citas.php?codigo=29933&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=29933&year=2019)