

Academic Year/course: 2021/22

## 30170 - Environmental engineering

### Syllabus Information

**Academic Year:** 2021/22

**Subject:** 30170 - Environmental engineering

**Faculty / School:** 179 - Centro Universitario de la Defensa - Zaragoza

**Degree:** 563 - Bachelor's Degree in Industrial Organisational Engineering

**ECTS:** 4.5

**Year:** 2

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:**

## 1. General information

### 1.1. Aims of the course

1. Provide students with the necessary knowledge to understand the current global environmental problems.
2. Train students in the identification and the minimization techniques of pollutants in water, atmosphere and caused by waste, enabling the students to apply measures to control the pollution.
3. Teach students the available techniques in the field of environmental management so that they will be able to apply environmental management systems at a basic level.
4. Teach students the general environmental regulations (European, state and regional).

### Specialization in Defense:

These objectives are in line with some of the Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree. The SDGs in which this course influences are the following:

- SDGs 1 No poverty
- SDGs 2 Zero hunger
- SDGs 3 Good health and well-being
- SDGs 5 Gender equality
- SDGs 6 Clean water and sanitation
- SDGs 7 Affordable and clean energy
- SDGs 9 Industry, innovation and infrastructure
- SDGs 11 Sustainable cities and communities
- SDGs 12 Responsible consumption and production
- SDGs 13 Climate action

- SDGs 14 Life below water
- SDGs 15 Life on land
- SDGs 16 Peace, justice and strong institutions

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

Environmental engineering teaches students of this degree with knowledge about environment which will enable them to take the responsibility to manage the environmental aspects of any organization. This subject gives a scientific and technological point of view about environment and its problems, focusing on the different types of existing pollutants and enabling students for the identification and evaluation of possible environmental impacts produced by the activity of any organization.

### Specialization in Defense:

In addition, this course contributes to the training of future Army Officers, providing knowledge on:

- Environmental problems, such as climate change or the loss of fertile soil, which can trigger large migratory flows that can be the origin of conflicts between countries.
- Scarce natural resources, such as oil, phosphorus or certain semiconductor metals, whose control can be and has been the origin of conflicts between countries.
- Decontamination procedures commonly used by the armed forces in the context of their operations, such as purification or adsorption of gases (NBC protection suit - Nuclear Biological Chemical).

Such knowledge can help future Army Officers to carry out their mission and thereby contribute to the development of Peace and Security.

## 1.3. Recommendations to take this course

The usual recommendations for any other engineering degrees, mainly to have attended the scientific and technical studies in the high school and to have a basic knowledge of chemistry.

## 2. Learning goals

### 2.1. Competences

C04 - Ability to solve problems and take decisions with initiative, creativity and critical reasoning.

C08 - Ability to analyse and evaluate the social and ecological impact of technical solutions, behaving ethically, with professional responsibility and social commitment, always striving for quality and continuous improvement.

C22 - Basic knowledge and application of environmental technologies and sustainability.

### 2.2. Learning goals

After attending this subject, students will be able to:

- Recognize and assess the effect that the pollutants cause in the receptor medium: atmosphere, water and soil.
- Analyze any industrial activity and identify the environmental problems which could be generated by that activity.
- Plan a strategy to prevent and control the pollution produced in some specific cases.
- Select the proper technique for the control of the pollution in some concrete cases.

- Analyze the environmental impact of different industrial activities.
- Know the fundamentals of an environmental management system in an industrial activity.
- Know the basic normative related with the environment (wastewater, atmosphere, wastes, environmental impact and integrated pollution control) and the obligations derived from it.

### 2.3. Importance of learning goals

This subject offers a holistic perspective of the environment, giving a global view of environmental factors and their interrelations. Then, the learning goals of this subject provide students with a theoretical basis and some practical capacities in terms of diminishing and controlling the pollution, enhancing their working capacity for the prevention, minimization and remediation, either in the planification stage or in the development and management of projects in companies and institutions.

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

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

This subject can be evaluated by continuous evaluation procedures during the course or by a global evaluation test.

#### Continuous evaluation procedure

Students could satisfactorily pass the subject through the continuous evaluation process. For this purpose, they must demonstrate they have achieved the expected learning outcomes by passing the evaluation instruments arranged in the 3 sections indicated below, which will be carried out throughout the four-month period:

1. **Theoretical-practical activities (TPA)** to evaluate the theory part (40 %). This evaluation instrument will consist of activities in which the student will have to demonstrate their ability to apply the theoretical contents of the subject.
2. **Problem-based exam (ExProb)** to assess the problems part of the course (50 %). Consist of solving problems related to the generation and emission of pollutants (liquid, gaseous and solid) into the environment and the treatments for their elimination and control.
3. **Practiceexam (ExPrac)** to evaluate the practical part (10 %). This exam will consist of questions in which the student will have to demonstrate his/her ability to apply the knowledge acquired in the laboratory practices.

Thus, the mark for the subject will be calculated as follows:

$$\text{Continuous Evaluation mark} = \text{TPA} \cdot 0,4 + \text{ExProb} \cdot 0,5 + \text{ExPrac} \cdot 0,1$$

To pass the course by means of continuous assessment, this mark must be greater than or equal to 5.

**IMPORTANT:** The marks obtained in each continuous evaluation activity must be greater than or equal to 4 to be averaged in the final mark, thus:

ATP mark  $\geq 4$

ExPrac mark  $\geq 4$

ExProb mark  $\geq 4$

## Global evaluation test

Students who do not successfully pass the subject by continuous evaluation or who would like to obtain a better mark, will have the right to attend the Global exam on dates fixed in the calendar for the first or second call, prevailing, in any case, the best of the marks obtained.

This global exam will consist of three parts:

1. **Theoretical-practical exam (ExTheo)** to evaluate the theory part (40 %).
2. **Problem-based Exam ("ExProb")** to assess the problem-based part (50 %).
3. **Practice exam (ExPrac)** to evaluate the practice part (10 %).

The final mark for this overall test will be calculated as follows:

Global Test mark = ExTheo - 0,4 + ExProb - 0,5 + ExPrac - 0,1

To pass the course by means of continuous assessment, this mark must be greater than or equal to 5.

**IMPORTANT:** The marks obtained in each continuous evaluation activity must be greater than or equal to 4 to be averaged in the final mark, thus:

ExTeo mark  $\geq 4$

ExPrac mark  $\geq 4$

ExProb mark  $\geq 4$

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

### 4.1. Methodological overview

If this teaching could not be done in person for health reasons, it would be done telematically.

The learning process designed for this subject is based on the development of theoretical-practical activities focused on environment pollution. The particular contents described in the verified manuscript of the degree and the corresponded credits are patented in these activities. The aim of these activities is to provide student with the expected learning outcome and the habits which help them in their professional and personal life.

### 4.2. Learning tasks

The teaching methodology consist of next active learning activities: lectures, practical sessions, problem-based learning, seminars, questionnaires, exams and finals. These activities could be complemented with non-presential ones like problem solving tasks, mini-project work, lab reports redaction and the personal study.

Through the Moodle platform the professoriate makes the activities program accessible for the students with its corresponded username and password in the web site <http://moodle.unizar.es>.

#### Teaching materials

During the course, audio-visual and paper-based materials will be used. Materials necessary for the development of the course will be provided through the Moodle platform: <http://moodle.unizar.es>.

### 4.3. Syllabus

#### Topic 1. Engineering concepts applied to the environment

1.1. Introduction to engineering calculations.

- 1.2. Mass balances.
- 1.3. Fluid flow concepts.
- 1.4. Separation processes.

#### **Topic 2. Water pollution**

- 2.1. Introduction.
- 2.2. Pollutants and its characterization.
- 2.3. Depuration treatments.

#### **Topic 3. Atmospheric pollution**

- 3.1. The atmosphere.
- 3.2. Air pollution.
- 3.3. Atmospheric pollution control.

#### **Topic 4. Waste pollution**

- 4.1. General concepts.
- 4.2. Properties of the waste.
- 4.3. Waste treatments.

#### **Topic 5. Environmental Management System (EMS)**

- 5.1. Introduction.
- 5.2. EMS Planning.
- 5.3. EMS Implementation.
- 5.4. EMS Certification.

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

Information about class calendars, class schedules and exam schedules will be published through the center website: <http://cud.unizar.es>.

Teachers will inform the students in person about the different activities that will be carried out during the course, all this information will be also available through the Moodle platform: <http://moodle.unizar.es>

Teaching materials or notes of the subject available in the Moodle Platform: <http://moodle.unizar.es>.

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

The recommended bibliography for this subject is available at this web address:

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=30170>