

## 29933 - Environmental engineering

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	435 - Bachelor's Degree in Chemical Engineering
ECTS	6.0
Year	4
Semester	Half-yearly
Subject Type	Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

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

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.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/>

### 5.2.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. A case study will be defined encompassing a global strategy for the pollution control in an industrial process. Additionally, exercises and case studies will be done in order to complement theoretical sessions. 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 in 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 sessions 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 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.

#### Non on-site activities: 3.6 ECTS, 90 hours.

1. Study (TP7): 90 hours. Includes study and problem solving. Continuous work by the student will be encouraged. Tutorials are also included in this section.

### 5.3.Syllabus

Module 1. Introduction. Environmental issues. Basics of prevention and control of pollution.

Module 2. Water pollution

Unit 1. Water cycle.

Unit 2. Types of water pollutants.

Unit 3. Physical processes/operations in water treatment.

Unit 4. Biological processes/operations in water treatment.

Unit 5. Chemical processes/operations in water treatment.

Unit 6. Water treatment facilities.

Module 3. Air pollution

Unit 1. The atmosphere and its pollution problems.

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Unit 2. Types of air pollutants: Primary pollutants

Unit 3. Pollutant measurements

Unit 4. Types of air pollutants: Secondary pollutants

Unit 5. Particle collection systems.

Unit 6. Pollutant control systems.

Module 4. Residues

Unit 1. Introduction.

Unit 2. Residues management and control

Unit 3. Recycling.

Unit 4. Biological treatments for residues.

Unit 5. Thermal treatment for residues.

Unit 6. Landfills.

Module 5. Environmental impact assessment (EIA) and environmental management systems (EMS): basic aspects.

### **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.

### **5.4.Course planning and calendar**

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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): 90 hours estimated.

### 5.5. Bibliography and recommended resources

- |           |   |
|-----------|---|
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| <b>BB</b> | 2. Ingeniería de aguas residuales : tratamiento, vertido y reutilización / Metcalf and Eddy ; revisado por George Tchobanoglous, Franklin L. Burton ; traducción y revisión técnica, Juan de Dios Trillo Montsoriu, Ian Trillo Fox ; prólogo de Angel Cajigas . - 3a. ed., [reimpr.] Madrid [etc.] : McGraw-Hill, D.L. 2000 |
| <b>BB</b> | 3.1 Design of municipal wastewater treatment plants. Volume I, Planing and configuration of Wastewater treatment plants . - 4th ed. Alexandria, VA (U.S.A.) : Water environment federation ; Reston : American society of civil engineers, cop. 1998  |
| <b>BB</b> | 3.2 Design of municipal wastewater treatment plants. Volume II, Liquid treatment processes . - 4th ed. Alexandria, VA (U.S.A.) : Water environment federation ; Reston : American society of civil engineers, cop. 1998   |
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