Universidad Zaragoza

**Year : 2019/20**

# 25210 - Foundations of environmental engineering

## Syllabus Information

**Academic Year:** 2019/20
**Subject:** 25210 - Foundations of environmental engineering
**Faculty / School:** 201 -

**Degree:** 277 - Degree in Environmental Sciences
571 - Degree in Environmental Sciences

**ECTS:** 6.0
**Year:** 3
**Semester:** First Four-month period
**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

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, seminars and laboratory sessions.

### 4.2.Learning tasks

This course is organized as follows:

- **Lectures** (3 ECTS: 30 hours) and **Practice sessions** (1 ECTS: 10 hours). Theory contents will be explained during lectures. Among these include those dedicated to solving problems (5 sessions of 2 hours), in which the participation of students will be promoted. Likewise, 3 two-hour sessions are dedicated for the resolution of cases in the computer room, cases specially focused on applying engineering concepts to the field of environmental science. Students will have the solutions for the problems for self-evaluation.
- **Seminars (0.6 ECTS: 6 hours).** Computer resolution (Excel and EES) of cases in the Field of Environmental Engineering. It is recommended that the student solve the cases raised during sessions. This activity will be assessed through written exams of theory and problems.

- **Laboratory sessions** (1 ECTS: 10 hours). 5 two-hour sessions. done in groups of 3 students. It is recommended that each student prepare a report containing the results of the measurements and the answers to the questions raised in the corresponding script prior to the session. Students will be provided through the teaching online platform solutions to the issues raised in the scripts of practice sessions for self-evaluation. However, in the period between two consecutive sessions of practice, the professor will address questions about the preparation of the report of the last practice done. Although the report is not evaluable, it is recalled that students may consult the written exam of laboratory practice.

## 4.3.Syllabus

This course will address the following topics:

**Lectures?**

Section I: Concept of Environmental Engineering

- Topic 1: Introduction to Environmental Engineering

Section II: Balances of matter and energy

- Topic 2: Material balances
- Topic 3: Energy balances

Section III: Indices environmental quality

- Topic 4: Quality indices

Section IV: physical separation processes

- Topic 5: Physical gas cleaning processes
- Topic 6: Physical processes of purification of liquid I
- Topic 7: Physical purification processes liquid II

Section V: Process of chemical and biological purification

- Topic 8: Chemical purification processes
- Topic 9: Biological purification processes

**Laboratory sessions**

Section II: Balances of matter and energy

- Session 1.- Heat Exchangers
- Session 2.- Adsorption

Section IV: physical separation processes

- Session 3.- Filtration
- Session 4.- Sedimentation

Section V: Process of chemical and biological purification

- Session 5.- Water softening by ion-exchange resins.
- Session 6.-Kinetics of oxidation of organic matter with $H_2O_2$ in the presence of UV light.

## 4.4.Course planning and calendar

**Schedule sessions and presentation of works**

It is estimated that an average student should devote to this subject a total of 150 hours, which should include both classroom activities and autonomous work and study. Therefore the amount of hours to be dedicated per student is as follows:

| Type activity / Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Classroom activity* | | | | | | | | | | | |
| Theory | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Computer cases | | 2 | | 2 | | 2 | | 2 | 2 | | 2 |
| Laboratory practices | | | 2 | | 2 | | 2 | | | 2 | |
| Evaluation | | | | | | | | | | | |
| *No classroom activity* | | | | | | | | | | | |
| Individual work | | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| Team work | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| TOTAL | 6 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

| Type activity / Week | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| *Classroom activity* | | | | | | | | | | *60* |
| Theory | 2 | | 2 | | | 2 | 2 | | | 30 |
| Computer cases | | | 2 | | | 2 | 2 | | | 20 |
| Laboratory practices | 2 | | | | | | | | | 10 |
| Evaluation | | | | | | | | 2 | | 2 |
| *N o classroom activity* | | | | | | | | | | 90 |
| Individual work | 3 | 3 | 3 | 7 | 7 | 7 | 7 | 4 | | 70 |
| Team work | 2 | 2 | | | | | | | | 20 |
| TOTAL | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | 150 |

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

### 4.5.Bibliography and recommended resources


**BB** Davis, Mackenzie Leo. Ingeniería y ciencias ambientales / Mackenzie L. Davis, Susan J. Masten ; revisión técnica, María Aurora Lanto Arriola, Juan Manuel Moreyra Mercado . México ; Madrid [etc.] : McGraw-Hill, 2004

**BB** Henry, J. Glynn. Ingeniería ambiental / J. Glynn Henry y Gary W. Heinke ; Con la participación de ...Ian Burton...[et al.] . Mexico : Prentice-Hall, cop. 1999

**BB** Muñoz Andrés, Vicenta. Bases de la ingeniería ambiental / Vicenta Muñoz Andrés, Jesús Álvarez Rodríguez . Madrid : Universidad Nacional de Educación a Distancia, 2011

**BC** Contaminación ambiental : una visión desde la química / Carmen Orozco Barrenetxea ... [et al.] . Madrid [etc.] : Thomson, D. L. 2002

**BC** Himmelblau, David M.. Balances de materia y energía / David M. Himmelblau ; traducción [de la 4a ed. en inglés] José Luis Rodríguez Huerta ; revisión técnica Gerardo Saucedo Castañeda . [1a ed. reimp] México [etc] : Prentice-Hall, 1993

**BC** Introducción a la ingeniería química / Editor Guillermo Calleja Pardo ; Autores Guillermo Calleja Pardo...[et al.]. Madrid : Síntesis, D.L. 1999

**URLs list:**

Confederación Hidrográfica del Ebro - [http://www.chebro.es/]

European Environment Agency - [http://www.eea.europa.eu/]

Gobierno de Aragón - [http://www.aragon.es/]

United States Environmental Protection Agency - [http://www.epa.gov/]

The updated recommended bibliography can be consulted in:
http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=25210&Identificador=C70903