

**COURSE DATA****Data Subject**

<b>Code</b>	43809
<b>Name</b>	Waste management and treatment
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2018 - 2019

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
2172 - M.U. en Ingeniería Ambiental	School of Engineering (ETSE)	1	First term
2227 - M.U. en Ingeniería Ambiental	School of Engineering (ETSE)	1	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2172 - M.U. en Ingeniería Ambiental	6 - Treatment of land, waste and air emissions	Obligatory
2227 - M.U. en Ingeniería Ambiental	3 - Treatment of land, waste and air emissions	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
BORRAS FALOMIR, LUIS	245 - Chemical Engineering
BOUZAS BLANCO, ALBERTO	245 - Chemical Engineering

**SUMMARY**

In the present subject it is intended that students know all management operations, from generation to final destination, both urban solid waste and hazardous waste, as well as propose, for a given type of waste, which it is the most appropriate management scheme according to the existing conditions. For this it is necessary to achieve the following specific objectives:

Know the operations of collection and transport of waste.

Study the different waste treatment operations: recovery of the organic fraction (composting and biomethanisation), recovery of the combustible fraction (incineration with energy recovery), physical and chemical treatment of hazardous waste and disposal operations.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

Relationship with other subjects of the same degree:

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements:

There are no specified enrollment restrictions with other subjects of the currículum.

## OUTCOMES

### 2172 - M.U. en Ingeniería Ambiental

- Students can apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
- Students are able to integrate knowledge and handle the complexity of formulating judgments based on information that, while being incomplete or limited, includes reflection on social and ethical responsibilities linked to the application of their knowledge and judgments.
- Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences, clearly and unambiguously.
- Students have the learning skills that will allow them to continue studying in a way that will be largely self-directed or autonomous.
- Students have the knowledge and understanding that provide a basis or an opportunity for originality in developing and/or applying ideas, often within a research context.
- Identify and apply technologies, tools and techniques in the field of environmental engineering.
- Assume with responsibility and ethics the Environmental Engineer role in a professional context.
- Promote and apply the principles of sustainability.
- Adapt to changes, being able to apply the principles of Environmental Engineering to unknown cases and use new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit.
- Identify, declare and entirely analyze environmental problems.
- Assess the application of measures for the pollution prevention and the recovery, protection and improvement of environmental quality.
- Carry out theoretical analyzes of environmental systems, both natural and artificial, and develop and apply mathematical models for their simulation, optimization or control.
- Design and calculate engineering solutions to environmental problems, comparing and selecting technical alternatives and identifying emerging technologies.
- Understand and apply environmental national and international legislation, adapting environmental solutions to these regulations.
- Be able to characterize the emissions to soils, coming from the anthropogenic activity.
- Evaluate the treatment of emissions to the atmosphere to assess different alternatives and obtain the required information for the design of the selected treatment processes.
- Design and manage treatment systems for contaminated soils.



## LEARNING OUTCOMES

- 1 Know all management operations, from generation to final destination, both urban solid waste and hazardous waste.
- 2 Know the different types of waste defined by legislation, its origin and fundamental properties.
- 3 Know the priorities in the management of waste, its regulation and planning at national and regional level.
- 4 To have the necessary knowledge and skills to organize, plan and manage waste management taking into account the external conditions and the geographical scope.
- 5 Know the main ways of using waste of different types.
- 6 Know the different methods and technologies used in the collection of waste and its transport to the management facilities.
- 7 Know the different methods and technologies used for the separation and classification of urban solid waste.
- 8 Be able to design and design facilities for the management of waste, both urban and industrial.
- 9 Be able to solve basic problems of design and exploitation of waste recovery and / or disposal facilities.
- 10 Know and be able to propose basic conceptual designs of the most important waste recovery facilities: composting, biomethanization and incineration.
- 11 Know the specific technologies for the treatment of hazardous waste.

## DESCRIPTION OF CONTENTS

### 1. 1

Introduction: Waste concept. Origins and type of wastes. Classification. Hazardous and non-hazardous waste. Production and composition of waste. Legal Framework: Legislation of the Autonomous, State and European Community.

### 2. 2

Physical, chemical and biological properties of solid waste. Introduction to the study of physical, chemical and biological transformations of urban solid waste. Comparative study of treatment methods.

### 3. 3

Waste management. Priorities in waste management. National and regional plans.

### 4. 4

Collection, transfer and transport of solid waste. Transfer and treatment centers.



### 5.5

Basic operations for the separation and processing of residual materials. Waste sorting plants for the recovery of waste materials.

### 6.6

Recovery of the organic fraction of non-hazardous waste (I): Composting. Microbiology of the process. Factors that intervene in the process. Phases of fermentation. Compost manufacturing process: Reception and classification, composting methods, fermentation and storage areas. Composting of vegetable waste.

### 7.7

Recovery of the organic fraction of non-hazardous waste (II): Biomethanization. Microbiology of the process. Factors that intervene in the process. Phases of digestion. Biomethanization process: conditioning of waste, digestion, collection and use of biogas and treatment of the solid fraction.

### 8.8

Valorisation of the combustible fraction: Incineration: combustion of waste, cooling of combustion fumes, control of air pollution, solid waste produced, thermal balance of an incinerator, combustion furnaces, treatment facilities for the resulting products, facilities of heat recovery. Gasification. Pyrolysis

### 9.9

Landfills. Selection of the location. Basic studies necessary for the writing of a project. Elements of a project. Classification of non-hazardous waste landfills. Teams and staff Methods of exploitation of non-hazardous waste landfills. Specific problems in the operation of a landfill. Recovery and subsequent use of landfills. Landfills for hazardous waste. Security deposits.

### 10.10

The hazardous waste. Most common treatments of hazardous waste. Physical and chemical treatments. Advanced treatments. Inerting techniques. Solidification and stabilization. Thermal destruction Industrial use of waste streams.

### 11.11

Management of special waste streams: hospital waste, end-of-life vehicles, used tires, used oils, etc.

**WORKLOAD**

<b>ACTIVITY</b>	<b>Hours</b>	<b>% To be attended</b>
Theory classes	25,00	100
Classroom practices	16,00	100
Other activities	5,00	100
Tutorials	5,00	100
Group work	4,00	100
Theoretical and practical classes	3,00	100
Seminars	2,00	100
Development of group work	20,00	0
Study and independent work	30,00	0
Preparation of practical classes and problem	20,00	0
Resolution of case studies	20,00	0
<b>TOTAL</b>	<b>150,00</b>	

**TEACHING METHODOLOGY**

The training activities will be developed according to the following distribution:

- Theoretical activities.

In the theoretical classes the topics will be developed providing a global and integrating vision, analyzing in greater detail the key aspects and of greater complexity, promoting, at all times, the participation of the student.

- Practical activities.

They complement the theoretical activities with the aim of applying the basic concepts and expanding them with the knowledge and experience that they acquire during the realization of the proposed works. They include the following types of face-to-face activities:

- Classes of problems and questions in the classroom.
- Discussion and problem solving sessions and exercises previously worked on by the students.
- Oral presentations.
- Visits to industrial facilities.
- Scheduled tutoring (individualized or in groups).

- Student's personal work.



Realization (outside the classroom) of monographic works, directed bibliographic search, issues and problems, as well as the preparation of classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

- Work in small groups.

Realization, by small groups of students (2-4) of work, issues, problems outside the classroom. This task complements the individual work and fosters the capacity for integration in work groups.

For the development of all these activities, the e-learning platform (Virtual Classroom of the Universitat de València and / or PoliformaT of the Universitat Politècnica de València) will be used as a communication support with the students. Through it you will have access to the didactic material used in class, as well as the problems and exercises to solve.

## EVALUATION

To evaluate the students' learning, a final exam will be carried out that will include both theoretical questions and problems and that will have a weight in the final grade of 50%.

The rest of the note will be obtained from the group work carried out by the students throughout the course (20%), as well as from the continuous evolution of each student (30%), based on the regular attendance at face-to-face classes, participation and degree of involvement of the student in the teaching-learning process, etc.

In order to complete the average, it will be necessary to obtain 4 points out of 10 in the group work and in the final exam, both in theory and in problems. To pass the subject it will be necessary to obtain an average score of 5 points out of 10.

The planned activities that the student must do outside the attendance will be coordinated between the different subjects of the master's degree and under the supervision of the Academic Coordination Committee of the Master.

In any case, the evaluation system will be governed by the provisions of the Regulation of Appraisal and Qualification of the University of Valencia per a títols de Grau i Màster (<http://links.uv.es/7S40pjF>).



## REFERENCES

### Basic

- - Seco Torrecillas, A., Segura Sobrino, F., Ferrer Polo, J. y Barat Baviera, R. (2003). Residuos Sólidos. Gestión y Tratamiento. Servicio de Publicaciones Universidad Politécnica de Valencia.
- Tchobanoglous, G., Theisen, H. y Vigil, S.A. (1994). Gestión Integral de Residuos Sólidos. McGraw Hill.
- Nemerow, N.L y Dasgupta, A. (1998). Tratamiento de vertidos industriales y peligrosos. Díaz de Santos.
- LaGrega, M.D., Buckingham, P.L. y Evans, J.C. (1996). Gestión de Residuos Tóxicos. Tratamiento, eliminación y recuperación de suelos. McGraw Hill.

### Additional

- - Polprasert, C. (2007). Organic waste recycling. IWA publishing, London
- Mata-Alvarez, J. (2003). Biomethanization of the organic fraction of municipal solid wastes. IWA publishing, London
- Abad, M. y Climent, M.D. (1996) El compost de residuos sólidos urbanos (R.S.U). Ediciones y Promociones L.A.V
- Lucena, A. (1998) Los residuos sólidos. Acento. Madrid.
- Castells, X.E. (2005) Tratamiento y valorización energética de residuos. Díaz de Santos.
- Ministerio de Medio Ambiente (1996) Actuaciones en infraestructuras para la gestión de residuos sólidos urbanos. Ministerio de Medio Ambiente. Madrid.
- Ministerio de Obras Públicas y Transportes (1991) Residuos tóxicos y peligrosos: Tratamiento y eliminación. Monografías de la Secretaría de Estado para las Políticas del Agua y el Medio Ambiente. Madrid.

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

**English version is not available**