

## Course guide

### 320073 - GTR - Waste Management and Treatment

**Last modified:** 19/04/2023

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 713 - EQ - Department of Chemical Engineering.

**Degree:** BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).  
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

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**Coordinating lecturer:** M<sup>a</sup> Dolores Alvarez del Castillo

**Others:**

#### TEACHING METHODOLOGY

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The course is divided into four types of sessions:

- Theoretical sessions and application of content. In these sessions, the professor will explain the theoretical basis of the material, concepts, and methods and illustrate them with appropriate examples to facilitate understanding.
- Lab sessions.
- Individual work. Students will spend time outside the classroom to understand the theoretical content.
- Work in pairs. Students will spend time outside the classroom to working in pairs to prepare the working laboratory sessions as directed by the teacher.

#### LEARNING OBJECTIVES OF THE SUBJECT

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The objectives of the course are to enable students to:

- Identify the different types of waste and the hierarchy of waste management.
- Identify and apply properly the key technologies for the treatment and recovery of waste.
- Identify the various stakeholders in the regulatory and legal aspects related to waste management.
- Correctly managing various waste that can be generated as a result of the production activity of company, using the current regulations.

#### STUDY LOAD

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Type	Hours	Percentage
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

**Total learning time:** 150 h

## CONTENTS

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### Topic 1. Introduction to waste

**Description:**

- Definition of waste
- Types of waste
- Generation of waste by type
- Administrative competences in the field of waste management.
- The waste hierarchy management.

**Full-or-part-time:** 2h 30m

Theory classes: 1h

Self study : 1h 30m

### Topic 2. Municipal waste. Generation, collection of structure

**Description:**

- Generation and composition of municipal waste
- Management of municipal waste. Collection and transportation operations, planning microroutes, economy collection, transfer plants.

**Full-or-part-time:** 7h 30m

Theory classes: 3h

Self study : 4h 30m

### Topic 3. MUNICIPAL WASTE. Biological treatment

**Description:**

- TMB Plants. Equipment and performance of separation treatments associated with different material flows. Composting plants. Biological basis of the process. Parameters to control. Inputs, transactions carried out in the plant and outputs. Performances
- Methanization plants
- Biological basis of the process. Parameters to control. Composition of biogas.
- Inputs, transactions carried out in the plant and outputs.
- Performances

**Related activities:**

- OFMSW Anaerobic digestion. Obtaining methane.

**Full-or-part-time:** 30h

Theory classes: 9h

Laboratory classes: 3h

Self study : 18h

#### Topic 4. Waste disposal

**Description:**

- Type of landfills (Class I, II, and III). Waterproofing, Exploitation Control, sealed. Elements of restoration.
- Reactions that take place in a landfill. Evolution processes in a landfill.
- Composition and treatment of leachate.
- Study of various leachate treatment technologies
- The process of biogas formation. Composition of biogas. Energy use.

**Related activities:**

- Lime treatment of landfill leachate. Determination of COD and N-ammonia.

**Full-or-part-time:** 25h

Theory classes: 6h

Laboratory classes: 4h

Self study : 15h

#### Topic 5. Heat treatment systems for waste

**Description:**

- The municipal waste as fuel. PCI, Humidity...
- Incineration of waste. Combustion process. Preparation residue. Types of furnaces. Energy efficiency. The incineration residue (ash and slag), gas emissions and gas treatment.
- CDR. Preparation of the residue for direct use, pyrolysis and gasification.

**Full-or-part-time:** 25h

Theory classes: 10h

Self study : 15h

#### Topic 6. Industrial Waste. Generation, structure and types

**Description:**

- Composition and industrial waste generation.
- Type of industrial waste (ES, NE). Characterization of the waste classification. Dam Festival. Leaching tests, analysis on the leaching residue

**Full-or-part-time:** 20h

Theory classes: 4h

Laboratory classes: 4h

Self study : 12h

### Topic 7. Industrial waste management.

**Description:**

- Possible Ways waste of industrial management. European Catalogue of Waste and Catalogue waste of Catalonia.
- Responsibilities. Control Documentation for the traceability and waste DAR, FA, FS., FSI, JRR, FD, FSAA
- Packaging waste. Statement of packaging waste. DERE. Business Plans prevention PEP. Hazardous waste minimization studies.
- Exchange of products.
- Regeneration of mineral oils
- Stabilization of a residue

**Related activities:**

Obtaining biodiesel from used vegetable oil.

**Full-or-part-time:** 40h

Theory classes: 12h

Laboratory classes: 4h

Self study : 24h

## GRADING SYSTEM

- 1st Exam: 35%
- 2nd Exam: 35%
- Delivering activities: 10%
- Lab: 20%

## EXAMINATION RULES.

Attendance at laboratory sessions is mandatory.

The unsatisfactory results of the First exam will be redirected through a written test that will be held in the same day as the second exam. All the students enrolled in the course can access to this second-chance.

The second-chance exam results will have a score between 0 and 10, and the score obtained will replace the initial score of the exam 1, as long as the score is higher.

## BIBLIOGRAPHY

**Basic:**

- Masters, Gilbert M.; Ela, Wendell P. Introducción a la ingeniería medioambiental [on line]. 3ª ed. Madrid: Prentice-Hall, 2008 [ Consultation: 20/09/2022 ]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=3884](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3884). ISBN 9788483224441.
- Elías, Xavier. Reciclaje de residuos industriales: residuos sólidos urbanos y fangos de depuradora. 2ª ed. Madrid: Díaz de Santos, 2009. ISBN 9788479788353.
- Orozco, Carmen [et al.]. Contaminación ambiental: una visión desde la química. Madrid: International Thomson, 2003. ISBN 8497321782.
- Huerta, Oscar [et al.]. Compostatge de residus municipals: control de procés, rendiment i qualitat del producte [on line]. Barcelona: Agència de Residus de Catalunya, 2010 [Consultation: 12/05/2020]. Available on: <http://hdl.handle.net/2117/9087>. ISBN 9788469330371.
- Elías, Xavier. Tratamiento y valorización energética de residuos. Madrid: Díaz de Santos, 2005. ISBN 8479786949.
- Tchobanoglous, G.; Theisen, H.; Vigil, S. Integrated solid waste management: engineering principles and management issues. London: McGraw-Hill, 1993. ISBN 9780070632370.