



## Course guide

# 240EQ312 - 240EQ312 - Waste Management and Treatment

Last modified: 11/07/2022

**Unit in charge:** Barcelona East School of Engineering  
**Teaching unit:** 713 - EQ - Department of Chemical Engineering.

**Degree:** MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Optional subject).

**Academic year:** 2022    **ECTS Credits:** 4.5    **Languages:** Catalan

### LECTURER

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**Coordinating lecturer:** VICENÇ MARTI GREGORIO

**Others:** Primer quadrimestre:  
IGNASI CASAS PONS - T10  
JOSE LUIS CORTINA PALLAS - T10  
VICENÇ MARTI GREGORIO - T10

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. Design, build and implement methods, processes and equipment for the supply and management of waste solids, liquids and gases in industries, capable of assessing their impacts and risks.

**Generical:**

2. Ability to analyze and synthesize to the continued progress of products, processes, systems and services using criteria of safety, affordability, quality and environmental management.
3. Conceive, design, calculate, and design processes, equipment, manufacturing and service facilities in the field of chemical engineering and related industrial sectors in terms of quality, safety, economy, rational and efficient use of natural resources and conservation environment.
4. Possess independent learning skills to maintain and enhance the competencies of chemical engineering to enable the continued development of their profession.

### TEACHING METHODOLOGY

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- Attending class favouring active participation (26%)
- Exercise attending class (12 %)
- Autonomous learning (non-attending) (52%)
- Cooperative learning (non-attending) (10%)

These methodologies include a visit to a waste treatment installation, the development of works on waste management and treatment case studies and the organization of a workshop where the students will expose the work performed

This subject has re-evaluation in fall quadrimester. In this re-evaluation the NEF mark will substitute the old one to reach the approved.

### LEARNING OBJECTIVES OF THE SUBJECT

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The subject is addressed to obtain knowledge and competences in the field of management and treatment of wastes, starting from the problems associated to each typology. Objectives, thus, include:

- Identification of each typology of wastes and the type of management to apply
- Identify and apply in an adequate way the main technologies of treatment, valorization or disposal of wastes
- To manage in a correct way the different types of wastes that could be generated in specific activities



## STUDY LOAD

Type	Hours	Percentage
Hours small group	40,5	36.00
Self study	72,0	64.00

**Total learning time:** 112.5 h

## CONTENTS

### 1-INTRODUCTION AND FUNDAMENTALS

**Description:**

Introduction of key concepts in the characterization, classification, management and treatment of wastes linked to environment and sustainability: reusing, recycling, recovery, minimization, valorization, treatment, disposal, type of wastes and their management attending to its origin (urban, industrial, agricultural, forestal and farm wastes, construction, mining, sanitary and specific) and impact on environment. Waste management plans and byproduct database

**Specific objectives:**

Fundamentals Knowledge

**Full-or-part-time:** 5h

Theory classes: 2h

Self study : 3h

### 2-CLASSIFICATION AND CHARACTERIZATION OF WASTES

**Description:**

Characterization, classification (waste catalogue risk phrase), management and treatment of Industrial wastes and its legal framework will be considered. Analytical methods for classification and disposal of industrial waste and characterization of urban wastes for disposal will be exposed

**Specific objectives:**

Knowledge for classification of wastes and legal framework

**Full-or-part-time:** 15h

Theory classes: 4h

Practical classes: 2h

Self study : 9h

### 3-PHYSICAL OR PHYSICO-CHEMICAL TREATMENT PROCESSES

**Description:**

Properties of contaminants linked to these treatments, description of fundamentals of mechanical separation, stripping, vapour extraction, adsorption, chemical oxidation, supercritical fluid extraction, membrane processes, stabilization and other

**Specific objectives:**

Knowledge of waste treatment

**Full-or-part-time:** 18h 30m

Theory classes: 6h

Practical classes: 3h

Self study : 9h 30m



#### 4-BIOLOGICAL TREATMENT PROCESSES

**Description:**

Fundamentals of biological processes (electron acceptors and electron donors, Monod, microbiological kinetics) and the description of composting and anaerobic digestion plants from FORM, other biotreatments of contaminants (lagooning, leaching phase, in-situ treatment, fitotreatment and other

**Specific objectives:**

Knowledge of waste treatment

**Full-or-part-time:** 16h

Theory classes: 4h

Practical classes: 2h

Self study : 10h

#### 5-THERMAL TREATMENT PROCESSES

**Description:**

Description of drying, combustion, incineration, pyrolysis, gasification, thermal desorption, vitrification, thermic plasma, and other techniques

**Specific objectives:**

Knowledge of waste treatment

**Full-or-part-time:** 14h

Theory classes: 4h

Practical classes: 2h

Self study : 8h

#### 6-ENERGETIC VALORIZATION OF WASTES

**Description:**

Description of techniques and instalations used to obtain the thermal energy by using cogeneration, biomass, biocombustibles, energy cell, biogas and other

**Specific objectives:**

Knowledge of energetic valorization

**Full-or-part-time:** 12h

Theory classes: 3h

Practical classes: 2h

Self study : 7h

#### 7 -CONTROLLED DISPOSAL OF WASTES

**Description:**

Type of landfills used for differnt wastes (construction, inert, non-inert, special), design of landfill, lixiviates and its management. Gas reactions and its evolution and treatment

**Specific objectives:**

Knowledge on waste disposal

**Full-or-part-time:** 11h

Theory classes: 3h

Practical classes: 1h

Self study : 7h



## 8-RADIOACTIVE WASTES

**Description:**

Fundamentals on radiation, wastes of low, medium and high activity, nuclear power plant impact, type of storage (ATC, AGP, low activity)

**Specific objectives:**

Knowledge on waste disposal

**Full-or-part-time:** 8h

Theory classes: 2h

Practical classes: 2h

Self study : 4h

## VISIT TO A WASTE TREATMENT INSTALLATION

**Description:**

Acquisition of direct knowledge from an installation dedicated to waste management and treatment

**Specific objectives:**

Know a real case study about waste management

**Related activities:**

Visit to management/treatment installation

**Full-or-part-time:** 3h

Theory classes: 2h

Self study : 1h

## WORK AND PRESENTATION

**Description:**

Assessment of an academic work, presentation of results in a workshop

**Specific objectives:**

Develop cooperative learning

**Related activities:**

Specific work on waste management

**Full-or-part-time:** 10h

Theory classes: 1h

Self study : 9h



## ACTIVITIES

### -VISIT TO A COMPANY OF WASTE MANAGEMENT

**Description:**

Visit to a waste management company

**Specific objectives:**

Know real case studies on waste management

**Delivery:**

Questionnaire to be delivered by the student by the Digital Campus

**Full-or-part-time:** 3h

Theory classes: 2h

Self study: 1h

### - COURSEWORK ABOUT THE WASTE MANAGEMENT

**Description:**

Work in groups to elaborate and expose a coursework related to waste management or treatment

**Specific objectives:**

Work in depth the coursework and develop a cooperative learning

**Material:**

Specialized bibliographies and magazines and electronic books available in the libraries

**Delivery:**

Delivery on the digital campus for its evaluation

**Full-or-part-time:** 10h

Theory classes: 1h

Self study: 9h

### - PARTIAL EXAM

**Description:**

General knowledge test in the middle of semester

**Full-or-part-time:** 26h 30m

Theory classes: 1h 30m

Self study: 25h

### - FINAL EXAMEN

**Description:**

Test performed at the end of semester

**Specific objectives:**

Demonstrate overall knowledge of the matter

**Full-or-part-time:** 33h

Theory classes: 3h

Self study: 30h



## - OTHER EVALUATIONS

**Description:**

Intermediate exercises for continuous evaluation

**Delivery:**

In the digital campus

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

Self study: 2h 30m

## GRADING SYSTEM

GLOBAL NOTE  $NT=0.1*NAC+0.1*NAC+ 0.2*NEP+ 0.6*NEP$

NAC1: Continuous evaluation+visit punctuation

NAC2: Case study work and exposition punctuation

NEP: Partial Exam Punctuation

NEF: Final Exam Punctuation

## EXAMINATION RULES.

The continuous evaluation exercises (including the related to the visit) will be delivered in digital virtual campus and will be individual

The case study work will be performed in group and will be delivered in digital virtual campus. A presentation of the works will be presented in the workshop (total time of workshop 1 hour)

Class notes, formulas and books could be used in EP and EF tests. An electronic calculator will be needed for these tests.

## BIBLIOGRAPHY

**Basic:**

- Tchobanoglous, George; Theisen, Hilary; Vigil, Samuel. Gestión integral de residuos sólidos. Madrid [etc.]: McGraw-Hill, cop. 1994. ISBN 8448118308.

- LaGrega, Michael D.. Gestión de residuos tóxicos : tratamiento, eliminación y recuperación de suelos. Madrid [etc.]: McGraw-Hill, 1996. ISBN 8448107128.

- Elias, Xavier (ed.). Reciclaje de residuos industriales : residuos sólidos urbanos y fangos de depuradora. 2a ed. Madrid: Diaz de Santos, cop. 2009. ISBN 9788479788353.

**Complementary:**

- Mata Álvarez, Joan. Digestió anaeròbica de residus sòlids urbans. [Barcelona]: Diputació de Barcelona. Àrea de Medi Ambient, 2002. ISBN 8477948658.

- Pérez Dueñas, Lara [et al.]. Guía de caracterización de residuos peligrosos. Bilbao: Ategrus, cop. 2008. ISBN 9788461229628.

- Pons, Jordi; Martell, Meritxell; Pon, Jordi. Llibre blanc de la gestió de residus industrials a Catalunya. Barcelona: Càtedra Enresa-Enviros en Sostenibilitat i Gestió de Residus, 2004. ISBN 8476538588.

## RESOURCES

**Other resources:**

Documentation from Waste Calatan Agency (ARC)