Course guide
250673 - 250673 - Characterization, Management and Treatment of Waste

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Compulsory subject).
Academic year: 2022  ECTS Credits: 5.0  Languages: Spanish

LECTURER
Coordinating lecturer: VICENÇ MARTI GREGORIO
Others: JOSE LUIS CORTINA PALLAS, JOAN DE PABLO RIBAS, VICENÇ MARTI GREGORIO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13340. Apply scientific concepts to environmental problems and their correlation with technological concepts.
13343. Identify, define and propose technological management and appropriate solution to an environmental problem.
13344. Dimension conventional treatment systems and raise their mass balance and energy.

Transversal:
8562. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

8563. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- 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.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.
LEARNING OBJECTIVES OF THE SUBJECT

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts.
CE04 - Identify, define and propose technological management and appropriate solution to an environmental problem.
CE05 - Dimension conventional treatment systems and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving environments, atmosphere, water and soil.
Explore scientific concepts and technical principles of management and treatment of gaseous emissions, water supply, sewage and waste and remediation techniques for groundwater and contaminated soils.
Sized systems for the treatment of major pollutants vectors.
Interprets rules, identifies goals, evaluates alternative techniques, proposes appropriate solutions and prioritize actions.

Production waste classification and producing sectors.
Thermal and chemical processes: incineration, gasification, pyrolysis, production of biodiesel.
Biochemical processes: aerobic decomposition, composting, anaerobic digestion, other biological transformation processes.
Treatment of sewage treatment plants: origin and characterization; flowchart for treatment, identification and characterization of processes, development of mass balances.
Controlled deposits: classification of deposits; considerations on the planning, design, operation and decommissioning; deposit as bioreactor, leachate and gas emissions.
Special waste. Inactivation processes, encapsulation and vitrification.

The subject is addressed to obtain knowledge and competences in the field of characterization, 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>12.00</td>
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<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>64.00</td>
</tr>
</tbody>
</table>

Total learning time: 125 h

CONTENTS

1 - INTRODUCTION AND FUNDAMENTALS

Description:
Introduction of key concepts in the characterization, classification, management and treatment of wastes; linear model and circular economy; hierarchy management (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); European List of Wastes

Specific objectives:
Fundamentals Knowledge

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study: 4h 11m
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 focused to different objectives.

Specific objectives:
Knowledge for classification of wastes and legal framework
See application examples

Full-or-part-time: 14h 23m
Theory classes: 3h
Practical classes: 3h
Self study : 8h 23m

3-REDUCING, REUSING AND RECYCLING STRATEGIES

Description:

Specific objectives:
Knowledge of waste management
See application examples

Full-or-part-time: 9h 36m
Theory classes: 2h
Practical classes: 2h
Self study : 5h 36m

4-TREATMENT FOR RECOVERY

Description:
Fundamentals of biological processes (electron acceptors and electron donors, Monod, microbiological kinetics) and the description of composting and anaerobic digestion plants from FORM, Mechanical-biological treatment.

Specific objectives:
Knowledge of waste treatment
See application examples

Full-or-part-time: 14h 23m
Theory classes: 3h
Practical classes: 3h
Self study : 8h 23m
5-TREATMENT OF HAZARDOUS WASTES

Description:
Description of mechanical separation, stripping, vapor extraction, adsorption, chemical oxidation, supercritical fluid extraction, membrane, stabilization and other, Biological treatment for hazardous waste.
Examples

Specific objectives:
Knowledge of waste treatment
See application examples

Full-or-part-time: 9h 36m
Theory classes: 2h
Practical classes: 2h
Self study: 5h 36m

6-WASTE TO FUEL AND WASTE TO ENERGY

Description:
Description of dewatering, combustion, incineration, pyrolysis, gasification, thermal desorption, vitrification, plasma and other. A description of the technical facilities and thermal energy production by cogeneration, biomass, biofuels, fuel cells, biogas and others.
Examples

Specific objectives:
Knowledge about management energy recovery
See application of examples

Full-or-part-time: 14h 23m
Theory classes: 3h
Practical classes: 3h
Self study: 8h 23m

7-CONTROLLED DISPOSAL OF WASTES

Description:

Specific objectives:
Simulation and application case studies. Activity evaluable

Full-or-part-time: 7h 11m
Laboratory classes: 3h
Self study: 4h 11m
## 8-SPECIAL WASTE MANAGEMENT TOPICS

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

**Specific objectives:**
Knowledge management disposal

**Full-or-part-time:** 7h 11m  
Theory classes: 3h  
Self study : 4h 11m

## GRADING SYSTEM

GLOBAL NOTE \(NT = 0.1 \times NAC1 + 0.1 \times NAC2 + 0.2 \times NEP + 0.6 \times NEF\)

- **NAC1:** Continuous evaluation  
- **NAC2:** Case study work and exposition punctuation  
- **NEP:** Partial Exam Punctuation  
- **NEF:** Final Exam Punctuation

For the re-evaluation only NEF will be substituted, maintaining the rest of punctuations. Students NP (Not present) cannot attend to reevaluation exam.

## EXAMINATION RULES.

The continuous evaluation exercises 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:**

**Complementary:**