240EQ312 - Waste Management and Treatment

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2017
Degree: MASTER’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
MASTER’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: Catalan

Teaching staff
Coordinator: VICENÇ MARTI GREGORIO
Others: JOSE LUIS CORTINA PALLAS - VICENÇ MARTI GREGORIO - IGNASI CASAS PONS

Opening hours
Timetable: See virtual digital campus

Degree competences to which the subject contributes

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.

General:
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

- 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 quatrimester. In this re-evaluation the NEF mark will substitute the old one to reach the approved.

Learning objectives of the subject

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:
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- 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

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 112h 30m</td>
<td>0h</td>
<td>0h</td>
<td>40h 30m</td>
<td>0h</td>
<td>72h</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>36.00%</td>
<td>0.00%</td>
<td>64.00%</td>
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</table>
## Content

### 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

**Learning 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

**Learning 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

**Learning 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 biotretaments of contaminants (lagooning, leaching phase, in-situ treatment, fitotreatment and other

**Specific objectives:**
Knowledge of waste treatment

**Learning time:** 16h
- Theory classes: 4h
- Practical classes: 2h
- Self study: 10h

## 5-THERMAL TREATMENT PROCESSES

**Description:**
Description of drying, combustion, incineration, pyrolisis, gasification, thermal desorption, vitrification, thermic plasma, and other techniques

**Specific objectives:**
Knowledge of waste treatment

**Learning 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

**Learning time:** 12h
- Theory classes: 3h
- Practical classes: 2h
- Self study: 7h
<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Specific objectives</th>
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</thead>
<tbody>
<tr>
<td>7 - CONTROLLED DISPOSAL OF WASTES</td>
<td>11h</td>
<td>Type of landfills used for different wastes (construction, inert, non-inert, special), design of landfill, lixiviates and its management. Gas reactions and its evolution and treatment</td>
<td>Knowledge on waste disposal</td>
</tr>
<tr>
<td>8 - RADIOACTIVE WASTES</td>
<td>8h</td>
<td>Fundamentals on radiation, wastes of low, medium and high activity, nuclear power plant impact, type of storage (ATC, AGP, low activity)</td>
<td>Knowledge on waste disposal</td>
</tr>
<tr>
<td>VISIT TO A WASTE TREATMENT INSTALLATION</td>
<td>3h</td>
<td>Acquisition of direct knowledge from an installation dedicated to waste management and treatment</td>
<td>Know a real case study about waste management</td>
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## WORK AND PRESENTATION

<table>
<thead>
<tr>
<th>Learning time: 10h</th>
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<tbody>
<tr>
<td>Theory classes: 1h</td>
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<tr>
<td>Self study: 9h</td>
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### Description:
Assessment of an academic work, presentation of results in a workshop

### Related activities:
Specific work on waste management

### Specific objectives:
Develop cooperative learning
# Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Theory classes:</th>
<th>Self study:</th>
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<tbody>
<tr>
<td><strong>VISIT TO A COMPANY OF WASTE MANAGEMENT</strong></td>
<td>3h</td>
<td>2h</td>
<td>1h</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Visit to a waste management company</td>
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<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
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<tr>
<td>Questionnaire to be delivered by the student by the Digital Campus</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
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<tr>
<td>Know real case studies on waste management</td>
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<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Theory classes:</th>
<th>Self study:</th>
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<tbody>
<tr>
<td><strong>- COURSEWORK ABOUT THE WASTE MANAGEMENT</strong></td>
<td>10h</td>
<td>1h</td>
<td>9h</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Work in groups to elaborate and expose a coursework related to waste management or treatment</td>
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<td><strong>Support materials:</strong></td>
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<td>Specialized bibliographies and magazines and electronic books available in the libraries</td>
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<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
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<tr>
<td>Delivery on the digital campus for its evaluation</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
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<tr>
<td>Work in depth the coursework and develop a cooperative learning</td>
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<tr>
<th>Activity</th>
<th>Hours</th>
<th>Theory classes:</th>
<th>Self study:</th>
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<tbody>
<tr>
<td><strong>- PARTIAL EXAM</strong></td>
<td>26h 30m</td>
<td>1h 30m</td>
<td>25h</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>General knowledge test in the middle of semester</td>
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<tr>
<th>Activity</th>
<th>Hours</th>
<th>Theory classes:</th>
<th>Self study:</th>
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<tbody>
<tr>
<td><strong>- FINAL EXAMEN</strong></td>
<td>33h</td>
<td>3h</td>
<td>30h</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Test performed at the end of semester</td>
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<td><strong>Specific objectives:</strong></td>
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<tr>
<td>Demonstrate overall knowledge of the matter</td>
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- OTHER EVALUATIONS

| Description: | Hours: 2h 30m
Self study: 2h 30m |
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<tbody>
<tr>
<td>Intermediate exercises for continuous evaluation</td>
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<tr>
<td>Descriptions of the assignments due and their relation to the assessment:</td>
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<tr>
<td>In the digital campus</td>
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Qualification system

GLOBAL NOTE NT=0.1*NAC + 0.1*NAC + 0.2*NEP + 0.6*NEF
NAC1: Continuous evaluation + visit punctuation
NAC2: Case study work and exposition punctuation
NEP: Partial Exam Punctuation
NEF: Final Exam Punctuation

Regulations for carrying out activities

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:


Complementary:


Others resources:

Documentation from Waste Catalan Agency (ARC)