250660 - CARGESTCAT - Characterization, Management and Treatment of Air Pollution

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Spanish, English

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

The course consists of 3 hours a week of classes in a classroom.

The 2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1 hour is devoted to solving practical problems with greater interaction with the students. The objective of these practical work and exercises is to consolidate the general and specific learning objectives.

Support material in the form of detailed teaching plan is used by: content, program of learning and assessment activities conducted and literature.

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.
250660 - CARGESTCAT - Characterization, Management and Treatment of Air Pollution

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.
Size systems for the treatment of major pollutants vectors.
Interpret rules, identifies goals, evaluates alternative techniques, proposes appropriate solutions and prioritize actions.

Features of the Earth's atmosphere.
Air pollutants.
Greenhouse gases.
Emission measurement.
Measure nuisance.
Analysis of air quality data.
Air quality criteria.
Pollutant emission sources.
Types of emission.
Emission factors and activity factors.
Review of the different emitting sectors.
Emission Control Systems.
Physico-chemical processes control gaseous pollutants (adsorption, absorption).
Physical and chemical processes controlling particle emissions (gravity separators, centrifugal separators, electrostatic precipitators, wet separators (scrubbers)).
Biological treatment processes gaseous emissions (biofilters and bioscrubbers).

Characteristics of the Earth's atmosphere.
Pollutants.
Greenhouse gases.
Measurement of emissions.
Measurement of immission.
Analysis of air quality data.
Air quality criteria.
Emission sources of pollutants.
Type of issue. Emission factors and activity factors.
Review of emitting sectors.
Emission control systems.
Physical and chemical processes control gaseous pollutants (adsorption, absorption).
Physical and chemical processes control particulate emissions (gravimetric separators, centrifugal separators, electrostatic precipitators, wet separators (scrubbers)).
Biological processes to treat gaseous emissions (biofilters and bioscrubbers).

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 15h</th>
<th>12.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 10h</td>
<td>8.00%</td>
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<tr>
<td></td>
<td>Laboratory classes: 10h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 10h</td>
<td>8.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
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</table>
## Content

<table>
<thead>
<tr>
<th>01 Characteristics of the Earth's atmosphere</th>
<th>Learning time: 7h 11m</th>
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</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>Self study : 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
- Structure of the atmosphere
- Chemical composition
- Atmospheric processes: temporal and spatial scales:
- Global Circulation
- Exercises and practical work

<table>
<thead>
<tr>
<th>02 Air pollutants. Greenhouse Gases</th>
<th>Learning time: 7h 11m</th>
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</thead>
<tbody>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td>Theory classes: 2h</td>
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<tr>
<td><img src="image5.png" alt="Image" /></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td>Self study : 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
- Composition of clean air
- Air pollutants: primary and secondary
- Aerosols
- Greenhouse Gases
- Atmospheric Lifetimes
- Combustion process
- Background levels
- Exercises and practical work

<table>
<thead>
<tr>
<th>03 Measurement of pollutants: emission and air quality</th>
<th>Learning time: 7h 11m</th>
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</thead>
<tbody>
<tr>
<td><img src="image7.png" alt="Image" /></td>
<td>Theory classes: 2h</td>
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<tr>
<td><img src="image8.png" alt="Image" /></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td><img src="image9.png" alt="Image" /></td>
<td>Self study : 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
- Emissions measurement systems
- Air quality: measures systems
- New measurement system
- Exercises and practical work

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Learning time: 16h 48m</th>
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<tbody>
<tr>
<td><img src="image10.png" alt="Image" /></td>
<td>Laboratory classes: 7h</td>
</tr>
<tr>
<td><img src="image11.png" alt="Image" /></td>
<td>Self study : 9h 48m</td>
</tr>
</tbody>
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## 04 Analysis of air quality data. Quality Criteria.

**Description:**
- Air quality measurements networks
- Type of air quality stations
- Levels of validity
- Quality Criteria
- Exercises and practical work

**Learning time:** 12h
- Theory classes: 4h
- Practical classes: 1h
- Self study : 7h

## 05 Pollutant Emission Sources

**Description:**
- Emission sources of pollutants
  - Emission rates
  - Emission factors and activity factors
  - Review of the different emitting sectors
  - Inventory and emission models
- Exercises and practical work

**Learning time:** 7h 11m
- Theory classes: 2h
- Practical classes: 1h
- Self study : 4h 11m

## 06 Emission Control Systems

**Description:**
- Pollution control systems
- Exercises and practical work

**Learning time:** 7h 11m
- Theory classes: 2h
- Practical classes: 1h
- Self study : 4h 11m
### 07 Pollution control: physical and chemical processes for gases

**Description:**
- Pollution control: physico-chemical processes for gases
- Absorption processes
- Adsorption processes
- Exercises and practical work

**Learning time:** 4h 48m
- Theory classes: 1h
- Practical classes: 1h
- Self study: 2h 48m

### 08 Pollution control: physical and chemical processes for particles

**Description:**
- Pollution control: physico-chemical processes for aerosols
  - gravity separators
  - centrifugal separators
  - electrostatic precipitators
  - wet separators
- Exercises and practical work

**Learning time:** 7h 11m
- Theory classes: 2h
- Practical classes: 1h
- Self study: 4h 11m

### 09 Pollution control: biological processes

**Description:**
- Biological treatment processes for gaseous emissions
  - biofilters
  - bioscrubbers
- Exercises and practical work

**Learning time:** 7h 11m
- Theory classes: 2h
- Practical classes: 1h
- Self study: 4h 11m
Qualification system

The course grade will be obtained from continuous assessment scores and corresponding practical work. Continuous assessment consists in several activities, both individually and in group, of additive and formative characteristics, carried out during the course (in the classroom and beyond). The evaluation tests consist of a part with basic issues and questions about concepts associated with the learning objectives of the course with in terms of knowledge or understanding concepts, and a set of exercises for understanding and application.

The teaching takes place according to the following criteria:

\[
NF = r \times NE + (1-r) \times NAC \\
NAC = q \times NAEP + (1-q) \times NACET
\]

- **NF**: Final Note
- **NE**: Exam Note
- **NAC**: Note from continuous assessment
- **NAEP**: Note teachings practical assessment (works, presentations, etc.)
- **NACET**: Note continued evaluation of the theoretical teachings (test, etc.)

Regulations for carrying out activities

Failure to perform practical work, laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

Bibliography

**Basic:**