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

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering.
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Compulsory subject).
Academic year: 2022  ECTS Credits: 5.0  Languages: Spanish

LECTURER
Coordinating lecturer: MARIA GONÇALVES AGEITOS
Others: JOSE M. BALDASANO RECIO, MARIA GONÇALVES AGEITOS, MARC GUEVARA VILARDELL

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 subject is developed in face-to-face sessions of 3 hours a week. These sessions are devoted to:

(1) theory classes: the professors explain the main concepts and basic materials of the matter, they present examples and analyze the main contents together with the students.

(2) in-class exercises: the students apply the theory concepts to solve problems and exercises with the aim of consolidating the general and specific learning objectives.

(3) teamwork supervision: the students develop, under teh professors supervision, a practical teamwork.

Support materials include: matter contents, programming of evaluation and supervised learning activities and literature.

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.

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.
Atmospheric pollutants.
Greenhouse gases.
Emission measurements.
Immission measurements.
Air quality data analysis.
Air quality criteria.
Sources of pollutants.
Overview of emission sectors.
Emission control systems.
Physical and chemical processes to control gaseous pollutants (adsorption, absorption).
Physical and chemical processes to 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>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>8.00</td>
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<tr>
<td>Hours medium group</td>
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<tr>
<td>Guided activities</td>
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<tr>
<td>Self study</td>
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<td>64.00</td>
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<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>12.00</td>
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</tbody>
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**Total learning time:** 125 h
## CONTENTS

### 01 Characteristics of the Earth’s atmosphere

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

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

### 02 Air pollutants. Greenhouse Gases

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

**Full-or-part-time:** 9h 36m  
- Theory classes: 3h  
- Practical classes: 1h  
- Self study: 5h 36m

### 03 Measurement of pollutants: emission and air quality

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

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

### Assessment

**Full-or-part-time:** 21h 36m  
- Laboratory classes: 9h  
- Self study: 12h 36m
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

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 2h
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

Full-or-part-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

Full-or-part-time: 4h 48m
Theory classes: 1h
Practical classes: 1h
Self study: 2h 48m

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

Full-or-part-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

**Full-or-part-time:** 4h 48m
Theory classes: 1h
Practical classes: 1h
Self study: 2h 48m

09 Pollution control: biological processes

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

**Full-or-part-time:** 4h 48m
Theory classes: 1h
Practical classes: 1h
Self study: 2h 48m

**GRADING SYSTEM**

The course grade will be obtained from the continuous assessment scores, the corresponding practical work and a written test.

The continuous assessment consists on several activities, carried out individually and in teams, of additive and formative characteristics, and developed along the course (in-class and outside). These activities include a teamwork and oral presentations.

The written test consists on a series of theory questions about concepts associated with the learning objectives, and practical exercises to apply the theory concepts.

The final grade will be calculated as a weighted average of the marks obtained in the different items:

- In-class continuous evaluation (30%)
- Contribution to teamwork and course presentations (30%)
- Written test (40%)

**EXAMINATION RULES.**

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

Basic: