Course guides

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: 2020
ECTS Credits: 5.0
Languages: English, 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 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.

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 pollutantatnts.
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>Self study</td>
<td>80,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>12.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.00</td>
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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:** 16h 48m  
Laboratory classes: 7h  
Self study: 9h 48m
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: 14h 23m
Theory classes: 4h
Practical classes: 2h
Self study : 8h 23m

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: 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

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 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:

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

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.)

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: