250667 - VALAMBMACO - Integrated Environmental Assessment of Building Materials

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2015
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 5  Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: PATRICIA TERESA PARDO TRAFACH
Others: PATRICIA TERESA PARDO TRAFACH

Opening hours
Timetable: Request an appointment at patricia.pardo@upc.edu

Teaching methodology
The course consists of 2 hours per week of classes in the classroom (large group).
During the theoretical lectures, the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises. The practical sessions are devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.
Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: 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.
CE08 - Dimension unconventional systems and advanced treatment and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving means, atmosphere, water and soil, and applied to problem solving.
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 in specific sectors of activity.
Interprets rules, identifies goals, assesses technical alternatives proposed unconventional solutions and priority actions.

Construction products. Historical development of characteristic materials.
Procedures for demolition and use of waste materials.
Deconstruction, separation and pretreatments.
Identification, characterization and utilization of waste from demolition and deconstruction.
Use in fillings, as aggregates in concrete and asphalt mixes.
Other industrial uses. Precast.
Environmental Assessment.
Leaching. Essays and limits.
Practical examples of application.

To give the student a broad and accurate methodological framework for assessing the environmental impact of different construction materials.
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To provide tools to establish strategies for recycling different materials by case studies.

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

<table>
<thead>
<tr>
<th>Chapter 1. Introduction</th>
<th>Learning time: 9h 36m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 4h</td>
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<tr>
<td></td>
<td>Self study : 5h 36m</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
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<tr>
<td>To inform students about the development of the course.</td>
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<tr>
<td>To distinguish different types of scientific documents and their structure. To learn to carry out literature searches. To know the parameters that indicate the quality of a scientific paper.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 2. Utilization of waste materials in construction</th>
<th>Learning time: 14h 23m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 5h</td>
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<tr>
<td>Type of building products. Historical evolution.</td>
<td>Laboratory classes: 1h</td>
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<tr>
<td>Demolition procedures and use of waste materials.</td>
<td>Self study : 8h 23m</td>
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<tr>
<td>Identification, characterization and utilization of waste.</td>
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<tr>
<td>Pretreatments.</td>
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<tr>
<td>Use as filler, aggregate i concrete and asphalt binders. Other industrial uses. Precast products.</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
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<tr>
<td>To describe the different products used in construction.</td>
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<tr>
<td>To know now the different wastes used in construction, their origins and treatments for its use.</td>
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<tr>
<td>To know the main applications of wastes in construction</td>
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</table>
Chapter 3. Pollutant retention and release

Learning time: 19h 12m
- Theory classes: 3h
- Practical classes: 2h
- Laboratory classes: 3h
- Self study: 11h 12m

Description:
Pollutant species. Heavy metals. Oxoanions
Instrumental analytical techniques. Principles and features.

Specific objectives:
- Know the theoretical basis of the main processes of retention and release of pollutants in a solid matrix.
- To solve problems on the concepts discussed in the previous session.
- To understand the main inorganic pollutants and the nature of their interaction with the solid matrix.
- To know the most used analytical techniques for residue analysis.

Chapter 4. Leaching

Learning time: 21h 36m
- Theory classes: 4h
- Practical classes: 4h
- Laboratory classes: 1h
- Self study: 12h 36m

Description:
Definition. Leaching mechanisms and factors controlling leaching. Leaching scenarios.
Problems on leaching tests.
Interpretation of the results obtained through a leaching test.

Specific objectives:
- To know the characteristics of the leaching phenomena in construction and building materials.
- To know the different laboratory tests used to evaluate the leaching process of a material.
- To earn how to transform and use the data obtained from a leaching test.
- To learn how to relate the data obtained in the laboratory with real case situations of application of a material.
Chapter 5. Environmental Impact Assessment | Learning time: 12h
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Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 1h  
Self study: 7h

**Description:**
Regulations related to the use of waste in construction. Leaching regulations. Regulatory framework ENV 12920 Methodologies for establishing limit values.  
Problems on setting limit values.

**Specific objectives:**
To know the regulatory framework affecting wastes in construction. To know the horizontal approach to organise the operational levels of leaching tests.  
to know different methods for setting limit values.  
To apply the knowledge acquired in the previous session.

Chapter 6. Numerical modeling | Learning time: 16h 48m
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Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 3h  
Self study: 9h 48m

**Description:**
Methods of numerical modeling. Introduction to PHREEQC.  
Problems with PHREEQC.  
Resolution of environmental problems using numerical models.

**Specific objectives:**
To learn the basics of numerical modeling methods. To know PHREEQC modeling software.  
To learn to solve simple problems with PHREEQC  
Case study of numerical modelling application to real environmental problems.

**Qualification system**

The mark of the course is obtained from the ratings of continuous assessment (60%) and of the evaluation tests (40%).

Continuous assessment consists in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.
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Regulations for carrying out activities

80% assistance.
Delivering of all activities of the continuous assessment.

Bibliography

Basic:


J. J Dijkstra; H. A. Van der Sloot; G. Spanka; G. Thielen. How to judge release of dangerous substances from construction products to soil and groundwater. 2005.


Complementary: