330055 - TMS - Environmental Technologies and Sustainability

Coordinating unit: 330 - EPSEM - Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ENERGY AND MINING RESOURCE ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: PERE BUSQUETS RUBIO
Others: Gorchs Altarriba, Roser
         Sole Sardans, M. Montserrat

Degree competences to which the subject contributes

Specific:
1. Basic knowledge and application of environmental technologies and sustainability.

Transversal:
2. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world’s situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
3. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
5. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
6. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
7. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.
330055 - TMS - Environmental Technologies and Sustainability

**Teaching methodology**

The subject consists of three hours a week of lectures (large group) and one hour a week of activities, problem solving, laboratory practicals, etc. (small group).

The directed learning hours consist in lectures in which the professor introduces the learning objectives for the subject and presents the basic subject matter. The practical class hours include exercises, debates, practicals, research and problem solving. Students are encouraged to actively participate in their own learning. Some of the activities are carried out in small groups and the generic teamwork competency is worked on.

Independent learning hours may be devoted to supervised reading, audiovisual displays, exercise solving, etc.

**Learning objectives of the subject**

On completion of the subject, students must be able to:

- Observe and analyse the world's complex reality from a sustainability perspective.
- Demonstrate knowledge of the causes that have led to the current unsustainable situation and particularly the role of technology.
- Demonstrate knowledge of the basic elements of human development and sustainability paradigms.
- Apply the concept of sustainability to engineering activities.
- Demonstrate knowledge of environmental technologies and their application in engineering.
- Understand and critically discuss environmental problems and propose solutions.
- Demonstrate knowledge of the main problems of water and air pollution and waste.
- Demonstrate in-depth knowledge of tools and practical methods for applying industrial ecology, such as ecodesign, waste management and clean manufacturing in a range of contexts. They must also be able to understand and apply energy and mass balances and the most common energy conversion systems.
- Present a topic orally with the support of audiovisual media.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
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<tr>
<td>45h 30.00%</td>
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<tr>
<td>Hours medium group:</td>
</tr>
<tr>
<td>0h 0.00%</td>
</tr>
<tr>
<td>Hours small group:</td>
</tr>
<tr>
<td>15h 10.00%</td>
</tr>
<tr>
<td>Guided activities:</td>
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<tr>
<td>0h 0.00%</td>
</tr>
<tr>
<td>Self study:</td>
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<tr>
<td>90h 60.00%</td>
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</tbody>
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## 1. SUSTAINABILITY

**Description:**
This topic covers:
- The state of the world: economic, political, social and environmental
- Science, technology and society. Economics and governability
- Sustainability paradigm. Concept of sustainable development
- Sustainability measurement. Indicators
- Cooperation and social commitment

**Related activities:**
Lectures with audiovisual support in large groups.
Directed activities 1, 2 and 3 are practicals that include audiovisual materials and debate, research, data processing and the drawing up of a report, the oral presentation of a topic, the design of a poster and an individual continuous assessment test.

<table>
<thead>
<tr>
<th>Learning time: 50h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
</tr>
<tr>
<td>Laboratory classes: 5h</td>
</tr>
<tr>
<td>Self study: 30h</td>
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</tbody>
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## 2. ENVIRONMENTAL TECHNOLOGIES

**Description:**
This topic covers:
- Natural and energy resources and sustainability
- Renewable energies
- Environmental water technology
- Environmental air technology
- Environmental waste technology

**Related activities:**
Lectures with audiovisual support in large groups.
Directed activities 4, 5 and 6 are practicals that include audiovisual materials and debate, research, data processing and the drawing up of a report and an individual continuous assessment test.

<table>
<thead>
<tr>
<th>Learning time: 50h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
</tr>
<tr>
<td>Laboratory classes: 5h</td>
</tr>
<tr>
<td>Self study: 30h</td>
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### 3. ENVIRONMENTAL MANAGEMENT

<table>
<thead>
<tr>
<th>Learning time: 50h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
</tr>
<tr>
<td>Laboratory classes: 5h</td>
</tr>
<tr>
<td>Self study: 30h</td>
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#### Description:
This topic covers:
- Environmental management tools: corporate social responsibility, integrated product policy, environmental auditing, environmental impact assessment, environmental management systems (ISO-14001 and EMAS), clean manufacturing, life cycle analysis, industrial ecology.
- Territory and mobility.

#### Related activities:
Related activities:
Lectures with audiovisual support in large groups.
Directed activities 7 and 8 are practicals that include audiovisual materials and debate, research, data processing and the drawing up of a report and an individual continuous assessment test.
### Planning of activities

#### SUSTAINABILITY: ACTIVITIES 1, 2 AND 3 (TOPIC 1)

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>- Practical session on information resources</td>
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<tr>
<td>- Poster on sustainability</td>
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<tr>
<td>- Video on sustainability, development cooperation or social impact of mineral resources</td>
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**Support materials:**
- Video, audiovisual, ATENEA virtual campus, internet

**Descriptions of the assignments due and their relation to the assessment:**
- A poster and oral presentation of slides on the world situation (continuous assessment)
- A study on a cooperation case (continuous assessment)
- Questionnaires

**Specific objectives:**
On completion of the activity, students must be able to:
- Demonstrate knowledge of the immediate causes of unsustainability.
- Demonstrate knowledge of the origin of and proposals for sustainable development.
- Demonstrate knowledge of the state of development cooperation.
- Demonstrate knowledge of the social impact of the main mineral resources.
- Demonstrate knowledge of the bibliographic tools that are available in the field of sustainability.

**Hours:** 15h  
Laboratory classes: 5h  
Self study: 10h

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#### ENVIRONMENTAL TECHNOLOGIES: ACTIVITIES 4, 5 AND 6 (TOPIC 2)

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>Energy puzzle</td>
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<tr>
<td>- Laboratory practicals on water pollution</td>
</tr>
<tr>
<td>- Laboratory practicals on air pollution or the environmental impact of mineral resources</td>
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</tbody>
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**Support materials:**
- Audiovisual materials, ATENEA virtual campus, databases, chemistry laboratories

**Descriptions of the assignments due and their relation to the assessment:**
- Questionnaires
- Reports on the laboratory practicals (continuous assessment)

**Hours:** 15h  
Laboratory classes: 5h  
Self study: 10h
Specific objectives:
On completion of the activity, students must be able to:
- Demonstrate knowledge of the environmental impact of the main mineral resources.
- Solve numerical problems and problems involving the evaluation and interpretation of data on water and air pollution.
- Identify and quantify given water and air pollutants.
- Demonstrate knowledge of the current energy situation and its alternatives.

ENVIRONMENTAL MANAGEMENT:
ACTIVITIES 7 AND 8 (TOPIC 3)  

Hours: 15h  
Laboratory classes: 5h  
Self study: 10h

Description:
- Environmental impact assessment
- Implementation of ISO 14001 in a small business or the comparison of two products using the life cycle analysis method

Support materials:
Practical cases and audiovisual materials
Spreadsheets and technical articles published in indexed journals

Descriptions of the assignments due and their relation to the assessment:
- Reports on practical cases (continuous assessment)

Specific objectives:
On completion of the activity, students must be able to:
- Demonstrate knowledge of the state of the art, theory and method of the ISO 14001 environmental management system.
- Carry out and interpret material flow and life cycle analyses.
- Demonstrate knowledge of the state of the art, theory and method of environmental impact assessment.

Qualification system
The final mark is calculated from the marks awarded for the following activities, according to the weighting shown:
\[ N_{\text{final}} = 0.375 \times N_{\text{p1}} + 0.375 \times N_{\text{p2}} + 0.25 \times N_{\text{aca}} \]
\( N_{\text{final}} \): final mark  
\( N_{\text{p1}} \): mark for the first individual test  
\( N_{\text{p2}} \): mark for the second individual test  
\( N_{\text{aca}} \): mark for continuous assessment activities

Regulations for carrying out activities
- No mark will be awarded for continuous assessment activities that have not been completed
Bibliography

Basic:


Complementary:


Others resources:

Pàgines web:
Web Tecnologia i Sostenibilitat:
http://tecnologiaisostenibilitat.cus.upc.edu/
Portal Sostenibilidad:
http://portalsostenibilidad.upc.edu/
Compra verde:
www.uab.cat/compraverda
Generalitat de Catalunya y ecodiseño:
www.gencat.net/mediamb/ipp/ecodisseny.htm
Productos sostenibles. IHOBE País Vasco
www.Productosostenible.net
Centro Catalan para el Reciclaje
http://www.arc-cat.net/es/CCR/
Ecoetiquetas
http://ec.europa.eu/environment/ecolabel/index_en.htm