240EM142 - Materials for Energy Applications

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2018
Degree: MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2009). (Teaching unit Optional)
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MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: English

Teaching staff
Coordinator: Roa Rovira, Joan Josep
Others: Valle Chiro, Jorge

Opening hours
Timetable: Working hours: Tuesday and Thursday between 13:00 to 15:00 h (Campus Diagonal Besos, EEBE. Building I. Office I1.6).

Prior skills
No one previous capacity.

Requirements
No one requirement.

Degree competences to which the subject contributes

Specific:
CEMCEM-02. (ENG) Dissenyar i desenvolupar productes, processos, sistemes i serveis, així com l’optimització d’altres ja desenvolupats, atenent a la selecció de materials per a aplicacions específiques
CEMCEM-03. (ENG) Aplicar mètodes innovadors en la resolució de problemes i aplicacions informàtiques adequades, pel disseny, simulació, optimització i control de processos de producció i transformació de materials
CEMCEM-07. (ENG) Dissenyar, calcular i modelar aspectes relacionats amb els materials per a components mecànics, estructures i equips

Transversal:
03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
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Teaching methodology

It will include lectures, seminars, industrial visits, participative sessions, exercises, among others. Students will choose a subject related to the course on which they will write a midterm and final project. Both projects will be presented in front the class by means an oral presentation. Several guest lecturers will be invited to describe their own area of expertise.

Learning objectives of the subject

During the academic course, it is required the knowledge of the following goals:

(i) To present an overview of energy as key feature regarding materials energy content (production, processing, use and recycling).

(ii) To show the critical role played by advanced materials for enabling efficient energy, transformation and storage, as well as energy-efficient transportation and housing.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group: 40h 30m</th>
<th>36.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours small group: 0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Guided activities: 0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study: 72h</td>
<td></td>
<td>64.00%</td>
</tr>
</tbody>
</table>
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## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Related activities</th>
<th>Learning time</th>
<th>Practical classes</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Energy and the Environment</td>
<td>The global energy landscape and energy security.</td>
<td>Conceptual maps. Directed activities. Midterm and final projects.</td>
<td>10h</td>
<td>3h</td>
<td>2h</td>
<td>5h</td>
</tr>
<tr>
<td>2. Materials energy content</td>
<td>Definition in terms of production, processing, use and recycling. Life-cycle assessment. Energy cost of materials. Economics of materials. Global materials flows.</td>
<td></td>
<td>21h</td>
<td>9h</td>
<td>7h 30m</td>
<td>4h 30m</td>
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<tr>
<td>3. Energy sources</td>
<td>Nonrenewable energy sources. Renewable energy sources.</td>
<td></td>
<td>9h</td>
<td>3h</td>
<td>6h</td>
<td></td>
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<tr>
<td>4. Advanced materials for enabling efficient energy harvesting.</td>
<td>Solar cells, nuclear materials, hard materials for oil/gas recovery, composites for wind energy, thermoelectrics.</td>
<td></td>
<td>10h</td>
<td>3h</td>
<td>2h</td>
<td>5h</td>
</tr>
</tbody>
</table>
5. **Advanced materials for enabling energy transformation.**

*Description:* Fuel cells, light emitting diodes, engines and turbines.

*Learning time:* 10h
- Practical classes: 3h
- Guided activities: 2h
- Self study: 5h

6. **Advanced materials for enabling energy storage.**

*Description:* Hydrogen storage, phase change materials.

*Learning time:* 7h 30m
- Practical classes: 1h 30m
- Guided activities: 1h 30m
- Self study: 4h 30m

7. **Advanced materials for energy-efficient industry related applications: transportation, manufacturing and housing.**

*Description:* Case studies related to effective implementation of materials in reference applications of industrial sectors: transportation, manufacturing and housing, among others.

*Learning time:* 27h
- Practical classes: 6h
- Guided activities: 6h
- Self study: 15h

**Qualification system**

- Short oral assessments (individual) (15%) between 4 and 5 activities along the course
- Midterm oral/written assessment (group) (25%)
- Final project (group) (50%)
- Participant’s attitude (in-class participation, etc) (10%)

**Regulations for carrying out activities**

The professor at the beginning of the course will supply to the students a scale (in order to evaluate the individual activities) as well as a rubric to evaluate the midterm and final Project.
Bibliography

Basic:


