240EM032 - Advanced Characterization of Materials

**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 Compulsory)  
MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)  
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2009). (Teaching unit Optional)  
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Teaching unit Optional)  
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Teaching unit Optional)

**ECTS credits:** 4.5  
**Teaching languages:** Spanish

**Teaching staff**

**Coordinator:** JOSE M. MANERO PLANELLA  
**Others:** Primer quadrimestre:  
JOSE M. MANERO PLANELLA - T11  
MARTA PEGUEROLES NEYRA - T11

**Opening hours**  
**Timetable:** Timetable is arranged between the teacher and the student.

**Prior skills**  
Knowledge of engineering materials, physics and chemistry

**Requirements**

**Degree competences to which the subject contributes**

**Specific:**  
CEMCEM-04. (ENG) Realitzar estudis de caracterització, avaluació i certificació de materials segons les seves aplicacions

**Transversal:**  
06 URI N3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

**Teaching methodology**

The classes will be taught in theoretical format, problems where the specific competences of the subject will be introduced. Face-to-face activities will be carried out to work on oral and written communication and teamwork.
The objective of the subject is that the student acquires knowledge of the different existing experimental techniques for the microstructural and physicochemical characterization of materials. Depending on the problem or needs of each case, the student must have sufficient criteria to select the most appropriate technique, as well as the interpretation of their results.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 112h 30m</td>
<td>27h</td>
<td>0h</td>
<td>13h 30m</td>
<td>0h</td>
<td>72h</td>
</tr>
<tr>
<td>24.00%</td>
<td>0.00%</td>
<td>12.00%</td>
<td>0.00%</td>
<td>64.00%</td>
<td></td>
</tr>
</tbody>
</table>
## Content

| 1. Introduction. The concept of microstructure. | Learning time: 4h  
Theory classes: 4h |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Structure-property relationships. Microstructural scale. Microstructural parameters. Interatomic bonding in solids. Crystalline and Amorphous phases. The crystal lattice.</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
</tbody>
</table>

| 2. X-ray diffraction analysis of the crystalline structure | Learning time: 3h  
Theory classes: 3h |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
</tbody>
</table>

| 3. Contact angle in surface analysis                     | Learning time: 5h  
Theory classes: 5h |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Determining surface energy of a homogeneous solid surface. Equation of state. Measuring contact angle. Static and dynamic sessile drop. Captive air bubble method.</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Description:**
Roughness evaluation. Techniques for roughness evaluation: profilometry, AFM. What is porosity? Basic principles of the porosity techniques.

**Related activities:**

**Specific objectives:**

<table>
<thead>
<tr>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
</tbody>
</table>

5. Spectroscopic analysis of surface composition.

**Description:**
X-Ray Photoelectron Spectroscopy. Fourier transform infrared spectroscopy.

**Related activities:**

**Specific objectives:**

<table>
<thead>
<tr>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
</tbody>
</table>

ELECTRON MICROSCOPY OF MATERIALS: 6
Interaction of an electron beam with a specimen. The physics of the process.

**Description:**

**Related activities:**

**Specific objectives:**

<table>
<thead>
<tr>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
</tbody>
</table>
### ELECTRON MICROSCOPY OF MATERIALS 7.
#### Fundamentals and techniques.

**Description:**

**Related activities:**

**Specific objectives:**

---

### ELECTRON MICROSCOPY OF MATERIALS:8.
#### Sample preparation.

**Description:**

**Related activities:**

**Specific objectives:**

---

### ELECTRON MICROSCOPY OF MATERIALS: 9.
#### Electron diffraction

**Description:**

**Related activities:**
Practical exercises for the electron diffraction patterns

**Specific objectives:**

---
The student's grade will be: Final grade = 0.5 (1st partial exam) + 0.5 (2nd partial exam). In case of re-evaluation, the student's grade will be: Final grade = Reevaluation exam. The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

### Qualification system

The student's grade will be: Final grade = 0.5 (1st partial exam) + 0.5 (2nd partial exam). In case of re-evaluation, the student's grade will be: Final grade = Reevaluation exam. The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

### Regulations for carrying out activities

### Bibliography

#### Basic:


