295766 - 295EM126 - Material Bonding Technology

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2019
Degree: MASTER'S DEGREE IN MATERIALS SCIENCE AND ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Teaching unit Optional)
ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Mateo Garcia, Antonio Manuel
Others: Santana Perez, Orlando Onofre
Cailloux, Jonathan
Sanchez Soto, Miguel Angel

Degree competences to which the subject contributes

Specific:
CEMCEAM-03. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones
CEMCEAM-04. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones

Transversal:
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
04 COE. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.

Teaching methodology

In the classes of theory, the basic concepts of the subject will be exposed, starting from textbooks as a general reference. The subject will be complemented with other materials, like outlines or summaries of the theoretical concepts and fundamental laws, tests to appraise the assimilation of the theoretical concepts, collections of problems, hyphens of practices, etc...
In the classes, the proposed test questions, which the students will have worked previously at home, attempting to favour a discussion of the concepts on the part of the students will be solved. Besides the blackboard different didactic resources will be used like transparencies and presentations with computer. Real pieces of material, representative varying ones of the different processes of union with faults and failures will be presented to the classes.

The practices of laboratory will be carried out by small groups and will consist of the realization of the practice in the laboratory and the writing of a report with the results and the discussion. They will allow that the student familiarizes himself with determinate instruments, that develop his critical observation and that approaches to the scientific method and becomes familiar to analyzing and presenting experimental results. The sessions of practices have duration of two hours. Together with the examination of theory, there will be an examination with questions about the sessions of laboratory practices.
The processes of materials joining are the fundamental topic.

Specific objectives:
- To know the main technologies of metals welding
- To understand the metallurgical changes in the welded material and their influence in the mechanical properties
- To understand the basic aspects of the adhesion, evaluation of the adhesion and the essential aspects about the effectiveness of the adhesive joints

As general objectives in the formation of the students:
- To promote the capacity to work in team.
- Promoting the development of critical analysis and scientific method
- To collaborate in the capacity to transmit knowledge in an oral way as well as written.
- Familiarize them with the use of the bibliography and of technical material in order to favour their self-learning capacity.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>28h</td>
<td>18.67%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>14h</td>
<td>9.33%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>102h</td>
<td>68.00%</td>
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</tbody>
</table>
There will be two partial exams, being at least 25% of the final qualification. Reports and problems have a minimum value of 20% of the final qualification. There will be a final exam and a retake exam.

### Content

#### Learning time:
- Theory classes: 28h
- Laboratory classes: 14h
- Guided activities: 6h
- Self study: 102h

#### Description:
1. **FUNDAMENTS OF WELDING**
   - Definitions. Importance of welding.
   - Types of welding. Physics of welding.

2. **WELDING PROCESSES**
   - Arc welding
   - Resistance welding
   - Gas welding
   - Solid state welding.
   - Filler metals. Fluxes.
   - Positions of the pieces in the welding. Preparation of the pieces to weld.
   - Cost of the welding.
   - Automatic welding.

3. **DEFECTS OF WELDING**
   - Deformations and internal tensions in the welding.
   - Defects of welding.

4. **ADHESIVE JOINTS**
   - General aspects about adhesion
   - Contact among the phases
   - Pretreatment of the surfaces

5. **MECHANICAL PROPERTIES OF THE ADHESIVE UNIONS**
   - Tests to evaluate the resistance to the separation of adhesive unions
   - Non destructive tests

6. **TYPES OF ADHESIVES**
   - Components on the formulations

### Qualification system

There will be two partial exams, being at least 25% of the final qualification. Reports and problems have a minimum value of 20% of the final qualification. There will be a final exam and a retake exam.
Bibliography

Basic:

