820022 - BMTB - Biomaterials

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2018
Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

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Opening hours
Timetable: Published in Atenea.

Requirements
Ciencia i Tecnologia de Materials (pre-requirement)
Fisiologia (pre-requirement)

Degree competences to which the subject contributes

Specific:
CEBIO-34. Discern the fundamental criteria that a material must meet before it can be implanted.
CEBIO-250. Identify the fundamental concepts and application principles of biomaterials and apply them to biomedical engineering problems.

Transversal:
1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Teaching methodology
The methods employed are:
- 30% presential lessons
- 5% directed presential work (problems)
- 10% laboratory classes
- 55% self-study

An important component of learning is based on the realization of a practical project in groups. It includes preparation and implementation of mechanical testing of biomaterials and programming and processing of the acquired data. It is an activity initially guided, but later the student must develop it more independently and linked to the knowledge acquired in the course.
Learning objectives of the subject

Upon completion of the course, the student shall be able to:
- understand the basic requirements of a biomaterial and the basic tests for its characterization.
- understand the fundamental basis and concepts of biomaterial application within biomedical engineering.
- be able to perform experimental testing on biomaterials.

Study load

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

<table>
<thead>
<tr>
<th>Definition, classification and properties of biomaterials</th>
<th>Learning time: 50h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 17h</td>
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<tr>
<td>Presentation of the characteristics of biomaterials: what is a biomaterial, how is it classified and what are their most important properties. Description of the main techniques used for biomaterial characterization.</td>
<td>Laboratory classes: 4h</td>
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<td><strong>Related activities:</strong></td>
<td>Self study : 29h</td>
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<td>Practical experience: 1.</td>
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<tr>
<td>Practice: Activity 2.</td>
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<tr>
<td>Partial control.</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
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<tr>
<td>Definition of Biomaterials.</td>
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<tr>
<td>Classification of biomaterials.</td>
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<td>Properties of Biomaterials.</td>
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<thead>
<tr>
<th>Biomaterials' behaviour in biological systems</th>
<th>Learning time: 20h</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 7h</td>
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<tr>
<td>Study the response of biomaterials implanted in a biological environment, the interaction with tissues and the mechanisms of degradation of implanted biomaterials.</td>
<td>Laboratory classes: 2h</td>
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<td><strong>Related activities:</strong></td>
<td>Self study : 11h</td>
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<tr>
<td>Practice: Activity 3.</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
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<tr>
<td>Properties of materials.</td>
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<td>Surface characterization of materials.</td>
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<tr>
<td>Biomaterial-tissue interaction.</td>
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<tr>
<td>Degradation of biomaterials in service.</td>
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</table>
### Definition and evaluation of biocompatibility

**Description:**
Definition of biocompatibility and description of the techniques used for its evaluation.

**Related activities:**
Practical experience: 4.

**Specific objectives:**
- Definition of Biocompatibility.
- Evaluation of Biocompatibility.

**Learning time:** 14h
- Theory classes: 4h
- Laboratory classes: 2h
- Self study: 8h

### Use of biomaterials in biomedical applications

**Description:**
A description of the main applications of biomaterials as components to implant in the human body.

**Related activities:**
Practical experience: 5.
Practical experience: 6.
Partial control.

**Specific objectives:**
- Biomaterials for hard tissue.
- Biomaterials for soft tissue.
- Biomaterials in contact with the cardiovascular system.

**Learning time:** 35h
- Theory classes: 12h
- Laboratory classes: 4h
- Self study: 19h

### New trends in biomaterials

**Description:**
Description of the recent trends in biomaterials research, their aims and future developments.

**Related activities:**
Final control.

**Specific objectives:**
Recent trends in biomaterials development.

**Learning time:** 29h
- Theory classes: 9h
- Self study: 20h
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Qualification system

Partial controls (2): 30%
Final control: 35%
Laboratory: 10%
Lab practicum and generic competences: 25%
This subject does not include a reevaluation test.

Regulations for carrying out activities

The use of devices with communication capabilities is not allowed.

Bibliography

Basic:

Complementary: