820036 - TEB - Tissue Engineering

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2019
Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6

Teaching staff
Coordinator: ELISABET ENGEL LOPEZ
Others: Primer quadrimestre:
SOLEDAD GRACIELA PEREZ AMODIO - T11

Opening hours
Timetable: Monday and Tuesday 17.00-18.00h

Requirements
Biology and Physiology.

Degree competences to which the subject contributes

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
2. 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
This subject uses the expositive methodology (theory) in a 30%, self study and work as well as group work (guided activities) in a 22% in class, self study and work as well as group work (non presential) in a 45%.
The professor will provide the students with the necessary bibliografy as well as scientific papers to be used to work at home and in class.

Learning objectives of the subject
The general objective is to treat the different issues that play a role in tissue engineering from a high interdisciplinar view. It is the aim that students can understand the need of controlling all factors related to biomaterials architecture, cell biology, biochemistry pathways, surface characterization and modification and the effect of different stimuli (physicals and chemicals), to be able to grow tissues through the discipline known as tissue engineering.
# Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Total learning time</td>
<td>150h</td>
<td></td>
</tr>
<tr>
<td>Hours large group</td>
<td>60h</td>
<td>40.00%</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Hours small group</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study</td>
<td>90h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>(ENG) · Theme 1. Introduction.</th>
<th>Learning time: 13h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 7h</td>
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</tbody>
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**Description:**
What is tissue engineering?. Bases: Materials, cells and stimuli.

**Related activities:**
Activity 1. Strategies in tissue engineering.

**Specific objectives:**
To understand the globality of this discipline and the interrelations among the different features.

<table>
<thead>
<tr>
<th>(ENG) · Theme 2. The cells.</th>
<th>Learning time: 17h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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<tr>
<td></td>
<td>Self study: 10h</td>
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**Description:**

**Related activities:**
Activity 2. Questions on stem cells.

**Specific objectives:**
To get knowledge in which cell types are available to be used in tissue engineering applications.

<table>
<thead>
<tr>
<th>(ENG) · Theme 3. Nanotechnology applied to tissue engineering.</th>
<th>Learning time: 6h</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
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<tr>
<td></td>
<td>Self study: 4h</td>
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**Description:**
Conference about nanotechnology tools to be used in tissue engineering.

**Related activities:**
Activity 3. Questions about the conference.
### Theme 4. Cells and materials interactions.

**Learning time:** 14h
- Theory classes: 6h
- Self study: 8h

**Description:**

**Related activities:**
Activity 4. Search for a scientific paper to illustrate each of the strategies.

**Specific objectives:**
To understand the relevance of the extracellular matrix and its interaction with materials.

### Theme 5. Biochemical stimuli.

**Learning time:** 9h
- Theory classes: 4h
- Self study: 5h

**Description:**
Growth factors and cytokines.

**Specific objectives:**
Get to know the type of factors and their effects.

### Theme 6. Surfaces: Properties, modification and characterization.

**Learning time:** 18h
- Theory classes: 7h
- Self study: 11h

**Description:**
Properties, modification and characterization.

**Related activities:**
Activity 5. Group activity that will present a paper given in class.

**Specific objectives:**
Get to know the surface properties of biomaterials and the characterization methods. Get to know the type and methodologies of surface modifications to apply then to different applications.
### Theme 7. Regenerative medicine vs bionics. Materials and devices.

**Learning time:** 11h  
Theory classes: 6h  
Self study: 5h

**Description:**  
Materials and devices.

**Specific objectives:**  
Get to know the different applications for tissue engineering and bionics.

### Theme 8. Products: from the bench to the market. Conference.

**Learning time:** 14h  
Theory classes: 4h  
Self study: 10h

**Description:**  
Conference.

**Related activities:**  
Activity 6. Debate.

**Specific objectives:**  
To understand the difficulties to go from basic research to commercialization of biomedical devices.

### Theme 9. Angiogenesis and vascularization.

**Learning time:** 4h  
Theory classes: 2h  
Self study: 2h

### Theme 10. Effect of mechanical stimuli. Mecanotransduction.

**Learning time:** 9h  
Theory classes: 4h  
Self study: 5h
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**Description:**
Final work of the course.

**Related activities:**
Activity 7. Students will prepare, in groups, a presentation getting together all what has been treated in the course and focus it in an specific application in tissue engineering.

**Specific objectives:**
Assolir la matèria donada durant el curs a partir de la búsqueda d'una aplicació concreta.

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**(ENG) - How to prepare a presentation?**

**Learning time:** 31h
- Theory classes: 6h
- Self study: 25h

**(ENG) - How to search and select information?**

**Learning time:** 2h
- Theory classes: 2h

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**Qualification system**

The evaluation will be by means of continuos evaluation.
Guided activities: 30%
Final presentation: 20%
Exam: 50% mid-term and final

Transversal competencies: EFFICIENT ORAL AND WRITTEN COMMUNICATION and EFFECTIVE USE OF INFORMATION RESOURCES: 5%
There will be re-valuation if the student has presented to the final exam.

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**Bibliography**

**Basic:**

