820023 - BMB - Biomechanics

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 Compulsory)
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ECTS credits: 6
Teaching languages: Catalan

Degree competences to which the subject contributes

Specific:
CEBIO-260. Analyse and reduce the loads applied to a biomechanical system. Assess the kinematic behaviour and strength of a joint and the strength behaviour of human tissue.

Transversal:
5. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
6. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
7. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology

There are 15 master sessions. Each one is dedicated to one of the content blocks. In the lectures the student adopts a receptive role.
Lab practices and problems will be conducted in seminar sessions. Problems are individual and practices are made in teams.

Learning objectives of the subject

1. Acquire the basic concepts and knowledge of biomechanics.
2. To know the structure, function and movement of the human body and the various joints.
3. To know the kinematic behavior of human joints and tissues.
4. To know the bioinstrumentation used for the analysis of biomechanics.

## Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>37h 30m</th>
<th>25.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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</tr>
<tr>
<td>Hours small group:</td>
<td>22h 30m</td>
<td>15.00%</td>
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<tr>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</tbody>
</table>
# Introduction

### Learning time: 3h
- Theory classes: 1h
- Laboratory classes: 0h 30m
- Self study: 1h 30m

### Description:
Introduction to the subject.

### Specific objectives:
Learn the key elements that make up the knowledge of mechanical physics.

## Fundamentals of biomechanics

### Learning time: 15h
- Theory classes: 6h
- Self study: 9h

### Description:
- Kinematics.
- Kinetics.
- Control of the movement.
- Joint stability.

### Related activities:
- Lab practice.
- Experimental work.
- Problems.

### Specific objectives:
Learn the basics and dynamic mechanical analysis and its application to the human body movement and the measurement tools.
### Tissue biomechanics of the musculoskeletal system

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone biomechanics</td>
<td>22h</td>
<td>13h 30m</td>
</tr>
<tr>
<td>Biomechanics of cartilage</td>
<td></td>
<td></td>
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<tr>
<td>Biomechanics of tendon and ligament</td>
<td></td>
<td></td>
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<tr>
<td>Biomechanics of muscle</td>
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<tr>
<td>Biomechanics of nervous tissue</td>
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<tr>
<td>Biomechanics of blood</td>
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</tbody>
</table>

| Related activities:                                                          |                |             |
| Lab practice and experimental work.                                          |                |             |

| Specific objectives:                                                         |                |             |
| Learn the key elements that make up the basics of biomechanics of tissues and be able to apply the methods to the study of musculoskeletal biomechanics. |                |             |

### Joint biomechanics

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomechanics of the hip</td>
<td>32h 30m</td>
<td>19h 30m</td>
</tr>
<tr>
<td>Biomechanics of the knee</td>
<td></td>
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<tr>
<td>Ankle Biomechanics</td>
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<tr>
<td>Foot Biomechanics</td>
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<td>Shoulder Biomechanics</td>
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<tr>
<td>Biomechanics of the elbow</td>
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<tr>
<td>Biomechanics of the wrist</td>
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</tbody>
</table>

| Related activities:                                                          |                |             |
| Lab practices                                                                 |                |             |
| Problems                                                                     |                |             |
| Experimental work                                                            |                |             |

| Specific objectives:                                                         |                |             |
| Learn the key elements that make up the basics of biomechanics of the joint structures and be able to apply the methods to the study of musculoskeletal biomechanics. |                |             |
### Biomechanics of the spine

**Description:**
Biomechanics of the spine

**Related activities:**
- Lab practices
- Problems
- Experimental work

**Specific objectives:**
Learn the key elements that make up the basics of biomechanics of the spine and be able to apply the methods of biomechanics to study the locomotor system.

**Learning time:** 12h 30m
- Theory classes: 3h
- Laboratory classes: 2h
- Self study: 7h 30m

### Human gait

**Description:**
Normal human gait

**Related activities:**
- Lab practices
- Experimental work

**Specific objectives:**
To learn the cycle of normal human gait and to determine, based on the same patterns, the role of each of the joints and tissues.

**Learning time:** 10h
- Theory classes: 4h
- Self study: 6h
Applied biomechanics

Description:
Pathological human gait
Analysis of forces and pressures. Parameters of human gait
Motion analysis system. Parameters of human gait
Electromyography. Parameters of human gait

Related activities:
Lab practices.

Specific objectives:
To learn about the instruments and biomechanical analysis of human gait and analyze their results.

Learning time: 55h
- Theory classes: 8h
- Laboratory classes: 14h
- Self study: 33h

Qualification system

The grade is based on:
- Participation in seminars: 10%
- Evaluation of practices and problems: 40%
- Parcial test: 15%
- Final test: 35%
This subject does not include a reevaluation test.

Regulations for carrying out activities

Attendance at practices and seminars is mandatory.
The use of devices with communication capabilities is not allowed.

Bibliography

Basic:

Complementary: