820025 - EMDTB - Monitoring, Diagnostic and Therapeutic Equipment

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Javier Rosell Ferrer
Others: Nescolarde Selva, Lexa Digna

Prior skills
To have passed the subject on Sensors, Conditioning and Acquisition of Biomedical Signals

Degree competences to which the subject contributes

Specific:
2. Identify, understand and apply the principles of the equipment and systems used for monitoring, diagnosing and treating patients.

Transversal:
1. 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
Expository methodology, group work and learning through guided activities

Learning objectives of the subject
To understand the concept of instrumentation systems. To know specific characteristics of biomedical systems and equipment. To understand and analyze monitoring, diagnostic and therapy biomedical systems and equipment datasheets

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</tbody>
</table>
# Content

<table>
<thead>
<tr>
<th>Topic 1: Measurement systems introduction</th>
<th>Learning time: 11h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Basic definitions. Biomedical instrumentation system general structure. Dynamic and static characteristics. Biomedical equipment definitory characteristics. Biomedical equipment classifications.</td>
<td></td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Self study: 5h</td>
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<tr>
<td>Classroom activity: static and dynamic characterization of two measurement systems</td>
<td></td>
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<tr>
<td>Deliverable 1: Characterization of a measurement systems</td>
<td></td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
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<tr>
<td>To understand the special characteristics of biomedical measurement systems.</td>
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</table>

<table>
<thead>
<tr>
<th>Topic 2: Bioelectric signals</th>
<th>Learning time: 25h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 9h</td>
</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td>Laboratory classes: 3h</td>
</tr>
<tr>
<td>Lab 1: ECG measurement, QRS detection and heart rate variability</td>
<td></td>
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<tr>
<td>Classroom activities: Comparison of characteristics of biopotential amplifiers. Interference analysis in a biopotential measurement system.</td>
<td></td>
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<tr>
<td>Deliverable 2: Biopotential amplifier analysis.</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td>Self study: 13h</td>
</tr>
<tr>
<td>To know the characteristics of the most important bioelectric signals and how they are acquired</td>
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</tbody>
</table>
### Topic 3: Measurements in the cardiovascular system

**Description:**

**Related activities:**
- Lab 2: Measurement of the pulse wave and transit time
- Classroom activity: Hydrostatic pressure effect on blood pressure estimation
- Deliverable 3: Fick's method

**Specific objectives:**
To know the signals to be measured and the measurement methods in the cardiovascular system.

**Learning time:** 17h
- Theory classes: 6h
- Laboratory classes: 3h
- Self study: 8h

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### Topic 4: Measurement in the respiratory system

**Description:**
Respiratory pressure and flow measurement. Lung volume measurement. Respiratory mechanics

**Related activities:**
- Lab 3: Breathing measurement and respiratory rhythm
- Classroom activity: Comparison of spirometers
- Deliverable 4: Apnea detection

**Specific objectives:**
To know the signals and measurement methods used to evaluate the respiratory system

**Learning time:** 17h
- Theory classes: 6h
- Laboratory classes: 3h
- Self study: 8h

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### Topic 5: Medical imaging equipment

**Description:**

**Related activities:**
- Classroom activities: X-ray atenuation across tissues, resonant frequency on MRI
- Deliverable 5: Transit time and Doppler shift in tissues

**Specific objectives:**
To know the measurement principles of medical imaging systems and their particular characteristics

**Learning time:** 15h
- Theory classes: 9h
- Self study: 6h
## Topic 6: Therapy equipment

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

<table>
<thead>
<tr>
<th>Description:</th>
<th>Surgery, diathermy, cryotherapy and lithotripsy equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related activities:</td>
<td>Classroom activity: electrosurgical units comparison</td>
</tr>
<tr>
<td></td>
<td>Deliverable 6: Cardiac ablation systems</td>
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<tr>
<td>Specific objectives:</td>
<td>To know the functional principles of therapy equipment</td>
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</table>

## Research project

**Learning time:** 56h  
Theory classes: 4h  
Laboratory classes: 6h  
Self study: 46h

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>9h</th>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>5h</td>
</tr>
<tr>
<td>Self study:</td>
<td>4h</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>6h</td>
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## Qualification system

Final exam: 30 %  
Midterm exam: 20%  
Guided Lab: 20%  
Research Project: 30%

## Bibliography

**Basic:**  

**Complementary:**  