Degree competences to which the subject contributes

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

4. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Learning objectives of the subject

The aim of this course is to train students in methods of design, and evaluation of biomedical systems covering all the design phases from conception to regulations compliance.

Learning results of the subject:

- Ability to understand the physical functions of sensors used to build biomedical equipment.
- Ability to design biomedical equipment ad-hoc to the field of utilization: low-noise systems, energy efficient systems, isolated systems, etc.
- Ability to understand the technical specifications of measurement equipment and electronic components used to design
biomedical instrumentation.
- Ability to design biomedical devices based on mobile devices.
- Ability to understand the regulations concerning biomedical systems.
- Ability to understand the test required to verify EMC and safety issues concerning biomedical systems.
- Ability to design biomedical instrumentation from simple circuits to complex systems for any field of use (monitoring patients at home, hospital machines, biomedical devices for non-medical applications etc.)
- Ability to interpret and analyze the systems design restrictions imposed by the field of use (explosive areas, sterile atmospheres etc.)
- Ability to create biomedical systems using specific sensors and mobile devices
- Ability to interpret the requirements from the medical standards, in the fields of safety, electromagnetic compatibility and usability.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 13h</th>
<th>10.40%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 26h</td>
<td>20.80%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 86h</td>
<td>68.80%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
</table>
| **1. Introduction to biomedical systems**                             | 5h            | - Aims of the subject  
- Basic definitions  
- Historic review |
| **2. Bioelectric signals**                                             | 70h           | - Electrobiological phenomena  
- Biomedical electrodes  
- Biopotential measurement systems  
- Medical equipment for biopotential measurement  
- Electrical bioimpedance measurement systems |
| **3. Safety of electrical equipment**                                  | 18h           | - Safety of Electrical equipment  
- Regulations and Standards |

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### 4. Measurements in the cardiovascular and respiratory systems

<table>
<thead>
<tr>
<th>Description</th>
<th>Learning time</th>
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</thead>
<tbody>
<tr>
<td>- Blood pressure measurements</td>
<td>32h</td>
</tr>
<tr>
<td>- Flux, flow and cardiac output measurements</td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>- Impedance plethysmography and impedance cardiography</td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>- Respiratory flux and respiratory volume</td>
<td>Self study: 24h</td>
</tr>
<tr>
<td>- Pulmonary ventilation monitors</td>
<td></td>
</tr>
</tbody>
</table>
# Planning of activities

| Theoretical Classes | Hours: 13h  
Theory classes: 13h |
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theoretical Classes</td>
</tr>
</tbody>
</table>
| LABORATORY | Hours: 26h  
Laboratory classes: 26h |
| **Description:** | - Bioelectrical signals amplifier.  
- Safety evaluation.  
- Respiration measurement. |
| EXERCISES | Hours: 26h  
Self study: 26h |
| **Description:** | Exercises to strengthen the theoretical knowledge. |
| SHORT ANSWER TEST | Hours: 1h  
Theory classes: 1h |
| **Description:** | Mid term control. |
| FINAL EXAMINATION: | Hours: 2h 30m  
Theory classes: 2h 30m |
| **Description:** | Final examination. |
| Self Study | Hours: 56h 30m  
Theory classes: 56h 30m |
Final examination: 30%
Partial examinations and controls: 5%
Exercises: 5%
Laboratory assessments: 60%

Bibliography

Basic:

Complementary: