230466 - PEF1 - Projects of Engineering Physics 1

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
748 - FIS - Department of Physics
739 - TSC - Department of Signal Theory and Communications

Academic year: 2019
Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: VICENTE JIMENEZ SERRES
Others: JOSEP ALTET SANAHUJES - CRINA MARIA COJOCARU - JOSE FRANCISCO TRULL SILVESTRE - MARÍA CONCEPCIÓN SANTOS BLANCO

Degree competences to which the subject contributes

Specific:

1. Knowledge of experimental techniques and procedures in the field of physics, engineering and nanotechnology. Ability to design experiments using the scientific method and criteria of efficiency, rationality and cost.


Generical:

6. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

7. ABILITY TO CONCEIVE, DESIGN, IMPLEMENT, AND OPERATE COMPLEX PHYSICAL ENGINEERING SYSTEMS. Ability to conceive, design, implement, and operate complex systems in the fields of micro and nano technology, electronics, advanced materials, photonics, biotechnology, and space and nuclear sciences.

Transversal:

1. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.

2. 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.

3. They will have acquired knowledge related to experiments and laboratory instruments and will be competent in a laboratory environment in the ICC field. They will know how to use the instruments and tools of telecommunications and electronic engineering and how to interpret manuals and specifications. They will be able to evaluate the errors and limitations associated with simulation measures and results.
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Teaching methodology

Lectures.
Individual work.
Team assignments (at home).
Laboratory sessions.

Learning objectives of the subject

Understand the problems associated with measurements and security in a lab environment.
Learn to analyze, measure and design basic analog circuits.
Be able to plan and develop a low complexity electronics project.
Understand light phenomena in geometric and wave optics.
Understand and analyze phenomena related to polarization, interference and diffraction.
Be able to build and analyze simple optics systems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>26h</th>
<th>17.33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>39h</td>
<td>26.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>85h</td>
<td>56.67%</td>
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</tbody>
</table>
# Content

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Introduction to laboratory</strong></td>
<td></td>
<td><strong>Description:</strong> Lab organization. Schedule. General lab rules. Final project description.</td>
</tr>
<tr>
<td><strong>Learning time:</strong></td>
<td>1h 30m</td>
<td></td>
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<tr>
<td><strong>Theory classes:</strong></td>
<td>1h</td>
<td></td>
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<tr>
<td><strong>Self study:</strong></td>
<td>0h 30m</td>
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<tr>
<td><strong>2. Security, errors and data processing</strong></td>
<td>9h</td>
<td><strong>Description:</strong> Electrical security. Connections and grounding. Errors. Basic data processing.</td>
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<tr>
<td><strong>Learning time:</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Theory classes:</strong></td>
<td>5h</td>
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<tr>
<td><strong>Self study:</strong></td>
<td>4h</td>
<td></td>
</tr>
<tr>
<td><strong>3. Optical theory</strong></td>
<td>18h 30m</td>
<td><strong>Description:</strong> 1. Light: Introduction, light sources and electromagnetic waves. 2. Geometric optics: Basic concepts, devices and aberrations. 3. Wave optics: Interference, diffraction and polarization.</td>
</tr>
<tr>
<td><strong>Learning time:</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Theory classes:</strong></td>
<td>10h</td>
<td></td>
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<tr>
<td><strong>Self study:</strong></td>
<td>8h 30m</td>
<td></td>
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<tr>
<td><strong>4. Basic start-up notions</strong></td>
<td>8h 30m</td>
<td></td>
</tr>
<tr>
<td><strong>Learning time:</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Theory classes:</strong></td>
<td>6h</td>
<td></td>
</tr>
<tr>
<td><strong>Self study:</strong></td>
<td>2h 30m</td>
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</tbody>
</table>
5. Electronics lab sessions

**Description:**
- A1: Static measurements.
- A2: Dynamic measurements.
- A3: Amplifiers.
- A4: Sensors.
- D1: Introduction to MCUs
- D2: Serial port.
- D3: Analog signals.
- D4: Interrupts.
- D5: Stepper motor control.

**Learning time:** 48h 30m  
Laboratory classes: 18h  
Self study: 30h 30m

6. Optic lab sessions

**Description:**
- 1: Refraction index measurement.
- 2 & 3: Light polarization.
- 4: Optical systems and image formation.
- 5: Interference and optical diffraction.
- 6: Interference and microwave diffraction.

**Learning time:** 32h 30m  
Laboratory classes: 12h  
Self study: 20h 30m

7. Development of an electronics project

**Description:**
Development of an electronic project following a sequence of phases:
- Project proposal and schedule.
- Project development.
- Project assessment and presentation.

The project can be selected from a pool of options or can be a new proposal. In any event the professors will check that its complexity is adequate.

**Learning time:** 31h 30m  
Guided activities: 14h  
Self study: 17h 30m
The final assessment will be a weighted mean between Optics (35%) and Electronics (65%).

Electronics assessment:
- Laboratory (60%)
- Calculations prior to class (10%)
- Lab work (20%)
- Final report (30%)
- Project (40%)
- Complexity (10%)
- Project plan (10%)
- Final report (20%)

Optics lab assessment:
- Calculations prior to class (20%)
- Lab work (20%)
- Final report (60%)

Bibliography

Basic:

Complementary: