Degree competences to which the subject contributes

Specific:
1. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

Teaching methodology

The learning of electromagnetism means to understand the theory concepts and know how to apply them in contextualized situations. For this reason, there is no temporary separation between the theory sessions and the sessions of resolving exercises. The expository character of the class will be given by the learning objectives set and the most suitable situation to promote their learning.

Learning objectives of the subject

- Acquisition of basic knowledge for a right interpretation and application of the fundamental principles of the electromagnetism.
- A complete knowledge of the electromagnetic theory fundamentals.
- Description of several physic phenomena by means of the electromagnetic theory.
- The familiarization with some of the most relevant applications of the electromagnetism.
- The resolution of easy numerical problems for which the electromagnetic theory is necessary.
## Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td>150h</td>
<td>52h</td>
<td>0h</td>
<td>8h</td>
<td>90h</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>34.67%</td>
<td>0.00%</td>
<td>5.33%</td>
<td>0.00%</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

<table>
<thead>
<tr>
<th>Theme 1: Electrostatic fields in the vacuum</th>
<th>Learning time: 23h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Fields theory. Electric charge. Coulomb's law. Electric field E. Electric potential V. Gauss's law. Equations of Poisson and Laplace. Potential energy.</td>
<td><strong>Learning time:</strong> 23h</td>
</tr>
<tr>
<td><strong>Theme 2: Conductors</strong></td>
<td><strong>Learning time:</strong> 18h</td>
</tr>
<tr>
<td><strong>Description:</strong> Electrostatic equilibrium of conductors. Electric field at the surface of a conductor. Capacity of an isolated conductor. Definition of capacitor and capacitance. Potential energy in a capacitor. Electrostatic pressure. Capacitors in parallel and in series.</td>
<td><strong>Learning time:</strong> 18h</td>
</tr>
<tr>
<td><strong>Theme 3: Electrostatic fields in dielectric media</strong></td>
<td><strong>Learning time:</strong> 20h</td>
</tr>
<tr>
<td><strong>Theme 4: Electrocinetic. Theory of circuits</strong></td>
<td><strong>Learning time:</strong> 21h</td>
</tr>
</tbody>
</table>
## Theme 5: Magnetostatic fields

**Learning time:** 26h  
- Theory classes: 3h  
- Practical classes: 5h  
- Laboratory classes: 2h  
- Self study: 16h

**Description:**  

## Theme 6: Electromagnetic induction

**Learning time:** 20h  
- Theory classes: 3h  
- Practical classes: 5h  
- Self study: 12h

**Description:**  

## Theme 7: Magnetisable materials

**Learning time:** 16h  
- Theory classes: 3h  
- Practical classes: 2h  
- Self study: 11h

**Description:**  

## Theme 8: Maxwell's equations

**Learning time:** 6h  
- Theory classes: 2h  
- Practical classes: 1h  
- Self study: 3h

**Description:**  
# Planning of activities

**EXPERIENCES IN THE LABORATORY**

<table>
<thead>
<tr>
<th>Description:</th>
<th>Hours: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>The working groups are constituted by two students. Every working group of students has to complete 3 experiences of two hours length in the laboratory. After finishing every one of the three experiences, working groups have to written a report answering questions concerning laboratory experiences. These reports should be hand in a week after the laboratory session.</td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>The available experiences are:</td>
<td>Self study: 9h</td>
</tr>
<tr>
<td>2. Electric permittivity of vacuum and relative permittivity of dielectric media.</td>
<td></td>
</tr>
<tr>
<td>5. Charge and discharge processes of a capacitor.</td>
<td></td>
</tr>
<tr>
<td>6. Magnetostatic field generated by a solenoid.</td>
<td></td>
</tr>
<tr>
<td>8. Evaluation of the horizontal component of the magnetic field of the Earth.</td>
<td></td>
</tr>
</tbody>
</table>

**Support materials:**
- Guides lab.

**Descriptions of the assignments due and their relation to the assessment:**
- Report practice.

## PARTIAL EXAM

**Description:**
- Assessment of knowledge.

**Descriptions of the assignments due and their relation to the assessment:**
- Solved exam.

## FINAL EXAM

**Description:**
- Assessment of knowledge.

**Descriptions of the assignments due and their relation to the assessment:**
- Solved exam.
The final exam (EF) will consist in a part which the student will have to answer some exercises. The test of the middle of the semester will consist in a closed questions questionnaire format. In both tests the student will be allowed to check a formulary given by the professor at the beginning of the course. Calculator can also be taken. Students must carry out three practices in the lab. Once the practice in the lab is performed, a report must be elaborated and handed in a week after the practice has been carried out.

\[ NTOT = 0.6 \times NEF + 0.25 \times NMQ + 0.15 \times NLAB \]

NTOT: Final mark of the subject
NEF: Mark of the final exam.
NMQ: Mark of the middle of the semester test
NLAB: Average mark of the lab reports.

**Bibliography**

**Basic:**

**Complementary:**

**Others resources:**
- ATENEA UPC