Degree competences to which the subject contributes

Specific:
1. AUD_BASIC: Ability to understand the basic concepts behind the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and understand how apply them to problems.

Transversal:
2. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Teaching methodology

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts, methods and results for the subject and use examples to facilitate students' understanding. Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set.

Learning objectives of the subject

To introduce some of the fundamental concepts of physics to gain a greater understanding of physical phenomena. To explain how the physical phenomena studied apply to the field of engineering. To familiarise students with critical thinking as a tool for problem solving. To familiarise students with various measurement techniques and instruments.

Familiarizing the student with the use of the critical reasoning as a tool for the resolution of problems. Familiarizing the student with the utilization of several instruments and techniques of measure.
### 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>Total learning time:</td>
<td>150h</td>
<td>30h</td>
<td>15h</td>
<td>15h</td>
<td>90h</td>
</tr>
<tr>
<td></td>
<td>20.00%</td>
<td>10.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

## Topic 1: MAGNETOSTATICS

<table>
<thead>
<tr>
<th>Description</th>
<th>Learning time: 40h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. Magnetic field:</td>
<td>Theory classes: 9h</td>
</tr>
<tr>
<td>1.1.1. Force exerted by a magnetic field</td>
<td>Practical classes: 4h 30m</td>
</tr>
<tr>
<td>1.1.2. Motion of a point charge in a uniform magnetic field</td>
<td>Self study: 27h</td>
</tr>
<tr>
<td>1.1.3. Lorentz force and its applications.</td>
<td></td>
</tr>
<tr>
<td>1.1.4. Action of a magnetic field on a current element, a current loop and a magnet coil.</td>
<td></td>
</tr>
<tr>
<td>1.1.5. The Hall effect</td>
<td></td>
</tr>
<tr>
<td>1.2. Sources of magnetic fields:</td>
<td></td>
</tr>
<tr>
<td>1.2.1. Magnetic fields produced by current elements. Biot-Savart law</td>
<td></td>
</tr>
<tr>
<td>1.2.2. Magnetic field produced by a point charge in motion along an indefinite rectilinear current and a circular loop.</td>
<td></td>
</tr>
<tr>
<td>1.2.3. Magnetic force between two parallel conductors. Definition of ampere and coulomb</td>
<td></td>
</tr>
<tr>
<td>1.2.4. Ampère's law</td>
<td></td>
</tr>
<tr>
<td>1.2.5. Magnetic field created by a coil</td>
<td></td>
</tr>
<tr>
<td>1.3. Magnetic properties of matter</td>
<td></td>
</tr>
</tbody>
</table>

| Related activities:                                                         |                         |
| Theory classes.                                                              |                         |
| Problem-solving classes.                                                     |                         |
| Practical laboratory sessions in which knowledge of the topic is applied.     |                         |

## Topic 2: MAGNETIC INDUCTION

<table>
<thead>
<tr>
<th>Description</th>
<th>Learning time: 18h</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. Magnetic flux.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>2.2. Induced electromotive force and the Faraday Lenz law.</td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>2.3. Motional electromotive force</td>
<td>Self study: 12h</td>
</tr>
<tr>
<td>2.4. Current sources</td>
<td></td>
</tr>
<tr>
<td>2.5. Foucault currents</td>
<td></td>
</tr>
<tr>
<td>2.7. Magnetic energy.</td>
<td></td>
</tr>
<tr>
<td>2.8. Energy density of the electromagnetic field</td>
<td></td>
</tr>
</tbody>
</table>

| Related activities:                                                         |                         |
| Theory classes.                                                              |                         |
| Problem-solving classes.                                                     |                         |
| Practical laboratory sessions in which knowledge of the topic is applied.     |                         |
### Topic 3: ELECTROMAGNETIC WAVES

**Description:**
3.1. Generalisation of Ampère's law. Displacement current  
3.2. Maxwell's equations in a vacuum  
3.3. Electromagnetic waves in a vacuum. Propagation speed.  
3.4. Polarisation  
3.5. Energy of an electromagnetic wave.  
3.6. Electromagnetic spectrum

**Related activities:**
- Theory classes.  
- Problem-solving classes.  
- Practical laboratory sessions in which knowledge of the topic is applied.

**Learning time:** 18h  
- Theory classes: 4h  
- Practical classes: 2h  
- Self study: 12h

### Topic 4: LIGHT

**Description:**
4.1. Wave-particle duality  
4.2. Sources of light  
4.3. Speed of light  
4.4. Propagation of light  
4.5. Reflection and refraction  
4.6. Polarisation

**Related activities:**
- Theory classes.  
- Problem-solving classes  
- Practical laboratory sessions for applying the theory covered for this topic

**Learning time:** 27h  
- Theory classes: 6h  
- Practical classes: 3h  
- Self study: 18h
### Topic 5: OPTICAL SYSTEMS

**Description:**
- 5.1. Mirrors
- 5.2. Lenses
- 5.3. Aberrations
- 5.4. Optical instruments

**Related activities:**
- Theory classes.
- Problem-solving classes.
- Practical laboratory sessions in which knowledge of the topic is applied.

**Learning time:** 13h 30m
- Theory classes: 3h
- Practical classes: 1h 30m
- Self study: 9h

### Topic 6: INTERFERENCE AND DIFFRACTION

**Description:**
- 6.1. Phase difference and coherence
- 6.2. Thin-film interference
- 6.3. Double-slit interference
- 6.4. Single-slit diffraction
- 6.5. Phasors
- 6.6. Fresnel diffraction and Fraunhofer diffraction
- 6.7. Diffraction and resolution
- 6.8. Diffraction networks

**Related activities:**
- Theory classes.
- Problem-solving classes.
- Practical laboratory sessions in which knowledge of the topic is applied.

**Learning time:** 18h
- Theory classes: 4h
- Practical classes: 2h
- Self study: 12h

### Planning of activities

<table>
<thead>
<tr>
<th>LABORATORY</th>
<th>Hours: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 15h</td>
</tr>
</tbody>
</table>
Qualification system

- Examinations: 75% (1st partial 37.5% and 2nd partial 37.5%)
- Laboratory sessions: 15%
- Works submitted and other proposed activities: 10%
- Retrieval of unsatisfactory results: there will a remedial of the 1st partial. Everybody will be able to take it. If the grade obtained in this remedial is greater than the grade of the 1st partial then this grade will be substituted by the grade of the remedial.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

Bibliography

Basic:


Complementary:


