240031 - Electromagnetism

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2018
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: FRANCISCO JAVIER LANA PONS
Others: CARINA SERRA DE LARROCHA
XAVIER LANA PONS

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>Total learning time: 150h</th>
<th>Hours large group: 52h</th>
<th>34.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td>Hours small group: 8h</td>
<td>5.33%</td>
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<tr>
<td>Guided activities: 0h</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Self study: 90h</td>
<td>60.00%</td>
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</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>Theory classes:</strong> 4h</td>
<td><strong>Practical classes:</strong> 4h</td>
</tr>
<tr>
<td><strong>Laboratory classes:</strong> 2h</td>
<td><strong>Self study:</strong> 13h</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme 2: Conductors</th>
<th>Learning time: 18h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory classes:</strong> 4h</td>
<td><strong>Practical classes:</strong> 4h</td>
</tr>
<tr>
<td><strong>Self study:</strong> 10h</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme 3: Electrostatic fields in dielectric media</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory classes:</strong> 3h</td>
<td><strong>Practical classes:</strong> 5h</td>
</tr>
<tr>
<td><strong>Self study:</strong> 12h</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Theme 4: Electrocinetic. Theory of circuits</th>
<th>Learning time: 21h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory classes:</strong> 2h</td>
<td><strong>Practical classes:</strong> 3h</td>
</tr>
<tr>
<td><strong>Laboratory classes:</strong> 2h</td>
<td><strong>Self study:</strong> 14h</td>
</tr>
</tbody>
</table>
Theme 5: Magnetostatic fields

Description:

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

Theme 6: Electromagnetic induction

Description:

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

Theme 7: Magnetisable materials

Description:

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

Theme 8: Maxwell's equations

Description:

Learning time: 6h
Theory classes: 2h
Practical classes: 1h
Self study: 3h
## Planning of activities

<table>
<thead>
<tr>
<th>EXPERIENCES IN THE LABORATORY</th>
<th>Hours: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study: 9h</td>
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</tbody>
</table>

### Description:
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.

The available experiences are:
2. Electric permittivity of vacuum and relative permittivity of dielectric media.
4. Charge and discharge processes of a capacitor.
5. Magnetostatic field generated by a solenoid.
6. Evaluation of the horizontal component of the magnetic field of the Earth.

### 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.
Qualification system

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.

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

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:

The address http://baldufa.upc.edu, through the link ¿Universitat¿, permits the access to teaching facilities consisting on theory notes. Solved problems and solved test questions, proposed in exams, are also available in this address.