Course guides
240031 - 240031 - Electromagnetism

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Compulsory subject).
BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2020 ECTS Credits: 6.0 Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: CARINA SERRA DE LARROCHA
Others: CARINA SERRA DE LARROCHA
XAVIER LANA PONS
RAÚL RODRÍGUEZ
FRANCESC ZARAGOZA

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 expositoriest 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

· Acquirement 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>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>8,0</td>
<td>5.33</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
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<tr>
<td>Hours large group</td>
<td>52,0</td>
<td>34.67</td>
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Total learning time: 150 h
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### Theme 1: Electrostatic fields in the vacuum

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<tr>
<td>Related competencies:</td>
<td>CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.</td>
</tr>
<tr>
<td>Full-or-part-time:</td>
<td>23h</td>
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<tr>
<td>Theory classes:</td>
<td>4h</td>
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<tr>
<td>Practical classes:</td>
<td>4h</td>
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<tr>
<td>Laboratory classes:</td>
<td>2h</td>
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<tr>
<td>Self study:</td>
<td>13h</td>
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### Theme 2: Conductors

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<td>Related competencies:</td>
<td>CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.</td>
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<tr>
<td>Full-or-part-time:</td>
<td>18h</td>
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<tr>
<td>Theory classes:</td>
<td>4h</td>
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<td>Practical classes:</td>
<td>4h</td>
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<tr>
<td>Self study:</td>
<td>10h</td>
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### Theme 3: Electrostatic fields in dielectric media

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<tr>
<td>Related competencies:</td>
<td>CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.</td>
</tr>
<tr>
<td>Full-or-part-time:</td>
<td>20h</td>
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<tr>
<td>Theory classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>5h</td>
</tr>
<tr>
<td>Self study:</td>
<td>12h</td>
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</tbody>
</table>
**Theme 4: Electrocinetic. Theory of circuits**

**Description:**

**Related competencies:**
CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

**Full-or-part-time:** 21h
- Theory classes: 2h
- Practical classes: 3h
- Laboratory classes: 2h
- Self study: 14h

**Theme 5: Magnetostatic fields**

**Description:**

**Related competencies:**
CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

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

**Theme 6: Electromagnetic induction**

**Description:**

**Related competencies:**
CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

**Full-or-part-time:** 20h
- Theory classes: 3h
- Practical classes: 5h
- Self study: 12h
Theme 7: Magnetisable materials

Description:

Related competencies:
CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

Full-or-part-time: 16h
Theory classes: 3h
Practical classes: 2h
Self study: 11h

Theme 8: Maxwell's equations

Description:

Related competencies:
CE2. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

Full-or-part-time: 6h
Theory classes: 2h
Practical classes: 1h
Self study: 3h
EXPERIENCES IN THE LABORATORY

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.

Material:
Guides lab.

Delivery:
Report practice.

Full-or-part-time: 15h
Laboratory classes: 6h
Self study: 9h

PARTIAL EXAM

Description:
Assessment of knowledge.

Delivery:
Solved exam.

FINAL EXAM

Description:
Assessment of knowledge.

Delivery:
Solved exam.
GRADING 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.

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

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:

RESOURCES

Other resources:
ATENEA UPC