Course guides
820005 - F2FE - Physics II: Fundamentals of Electromagnetism

Unit in charge: Barcelona East School of Engineering
Teaching unit: 748 - FIS - Department of Physics.
Degree:
- BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).
- BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
- BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

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

LECTURER

Coordinating lecturer: CRISTINA PERIAGO - POL LLOVERAS

Others:

PRIOR SKILLS

No prerequisites

REQUIREMENTS

No requirements

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Understand the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and apply them to engineering problems.

Transversal:
1. 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.

TEACHING METHODOLOGY

Teaching methodology: exposition 30%, individual work 60%, group work 8% and guided activities 2%.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective is training students through the acquisition of a working method and providing knowledge of the principles and basic concepts of electromagnetism, so that can be applied to solving problems in the field of engineering.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Item 1. Electric field and Potential

Description:
The electric charge. Coulomb's law. Principle of superposition. Electric field created by a system of discrete charge and continuous distributions. Gauss's law: 1st Maxwell equation. Potential energy and electric potential. Calculation of the potential created by a system of discrete charge and continuous charge distributions. Electric energy of a system of point charges

Specific objectives:
Understand the concept of electric field and its vector nature. Calculate the field created by a charge distribution. Interpret the concept of potential, potential difference and electrostatic potential energy of a charge distribution.

Full-or-part-time: 32h 30m
Theory classes: 10h
Laboratory classes: 2h
Guided activities: 1h
Self study: 19h 30m

Item 2. Conductors and dielectrics.

Description:

Specific objectives:
Knowing the characteristics of a conductor in electrostatic equilibrium. Calculate the capacity of a capacitor of simple geometry and calculate the capacitor equivalent to an association of capacitors. Understand the concept of electrostatic field energy. Characterize the response of a dielectric in an electric field.

Related activities:
Lab:
- Parallel-plate capacitor with sheets of dielectric material.

Full-or-part-time: 26h 15m
Theory classes: 10h
Guided activities: 0h 30m
Self study: 15h 45m
Item 3. DC and AC

Description:

Specific objectives:
Knowing how to establish relationships of macroscopic Ohm's law. Understand energy relationships in electrical circuits. Applying Kirchhoff's laws to solve circuits. Understand the process of charging and discharging a capacitor in an RC circuit. Working with alternating magnitudes. Determine the reactance and impedance in an RLC circuit. Identify and characterize the phenomenon of resonance. Knowing energy features of the AC.

Related activities:
Lab:
- Electromotive force and internal resistance of a battery
- DC Circuits. Kirchhoff rules
- Parallel-plate capacitor.
- AC Circuits. RLC serie. Reactances.
- AC Circuits. RLC serie. Resonance.

Full-or-part-time: 28h 45m
Theory classes: 5h
Practical classes: 6h
Guided activities: 0h 30m
Self study : 17h 15m

Item 4. Magnetic field

Description:

Specific objectives:
Identify the electrical current as a source of magnetic field. Being able to calculate the force acting on a charge or a straight thread in the presence of a magnetic field. Calculate the magnetic dipole moment of a loop and identify the characteristics of motion of a loop under the action of a magnetic field. Calculate the magnetic field created by a distribution of currents using the Biot and Savart's law. Knowing Ampere's law and its applications.

Related activities:
Lab:
- Magnetic field in the center of a solenoid. Determination of the mutual inductance between two solenoids

Full-or-part-time: 31h 15m
Theory classes: 10h
Laboratory classes: 2h
Guided activities: 0h 30m
Self study : 18h 45m
**Item 5. Electromagnetic induction**

**Description:**

**Specific objectives:**
Be able to relate the temporal variation of the flow of magnetic field with induction. To apply the Faraday-Lenz's law to calculate the electromotive force induced in different practical cases. Describe the inductive phenomena that appear in electric circuits. RL circuit.

**Related activities:**
Lab:
- Magnetic field created by a set of coils. Determination of mutual inductance between two coils.
- Electromagnetic induction. Determination of mutual inductance between two coils.

**Full-or-part-time:** 26h 15m
Theory classes: 8h
Laboratory classes: 2h
Guided activities: 0h 30m
Self study : 15h 45m

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**Item 6. Maxwell equations**

**Description:**

**Specific objectives:**
Explain the appearance of the displacement current in free space. Write Maxwell equations. Recognize the electromagnetic field in non-stationary situations.

**Full-or-part-time:** 5h
Theory classes: 2h
Self study : 3h

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**GRADING SYSTEM**

MARK M1:
- Lab: 20%
- Test 1: 15%
- Test 2: 25%
- Test 3: 20%
- Problems: 20%

MARK M2:
- Lab: 20%
- Test 3: 40%
- Problems: 40%

FINAL GRADE = maximum (M1;M2)

**EXAMINATION RULES.**

In all exams, students can use a pocket calculator and bring a printed copy of the physics formula sheet provided in Atenea. The final exam of Physics 2 consists of Test 3 and Problems. No re-evaluation exam has been considered in the grading policy of Physics 2.
BIBLIOGRAPHY

Basic: