230855 - FM - Physics of Materials

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2019
Degree: MASTER’S DEGREE IN ENGINEERING PHYSICS (Syllabus 2018). (Teaching unit Optional)
ECTS credits: 4
Teaching languages: English

Teaching staff
Coordinator: Pineda Soler, Eloy
Lloveras Muntane, Pol Marcel

Teaching methodology
Lectures: In the lectures the contents of the subject are exposed orally by a teacher without the active participation of the students.
Conferences: Presentations on a subject of scientific-technical character carried out by an expert in concrete items of the program.
Problem solving: In the problem solving activity, the teacher presents an exercise / problem that the student must solve, either working individually or in a team.
Projects: Active teaching methodology that promotes learning from the realization of a project: idea, design, planning, development and evaluation of the project.

Learning objectives of the subject
Ability to understand the physical origin and to evaluate the response of the materials to a mechanical, electrical or magnetic external stimulus.
To understand the coupling between the different properties and the multi-response mechanisms of the materials.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 100h</th>
<th>Hours large group:</th>
<th>36h</th>
<th>36.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>64h</td>
<td>64.00%</td>
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## Content

### Mechanical properties

**Description:**
1. Elasticity and related properties
2. Non-linear mechanical properties
3. Thermal expansion and isothermal compressibility

**Learning time:** 9h
**Theory classes:** 9h

### Optical and electrical properties

**Description:**
1. Polarization and polarization mechanisms
2. Ferroelectricity, Pyroelectricity, Piezoelectricity
3. Dielectric response to variable frequency electric fields
4. Optical response of materials

**Learning time:** 9h
**Theory classes:** 9h

### Magnetic properties

**Description:**
1. Diamagnetism
2. Paramagnetism
3. Ferromagnetism
4. Other types of magnetism: ferrimagnetism, antiferromagnetism and non-collinear ferromagnetism

**Learning time:** 9h
**Theory classes:** 9h

### Mechanical, electrical and magnetic coupling

**Description:**
1. Ferroic transitions
2. Multiferroic coupling: Magnetoelasticity and magnetoelectricity

**Learning time:** 9h
**Theory classes:** 9h
Qualification system

N1: Written tests. Exams, questionnaires, application activities and problem solving. N1 can be replaced by the mark of the re-evaluation exam.
N2: Reports done by the student. Memories, dossiers and projects.

Final qualification = 0.6N1 + 0.4N2