230912 - EAFO - Applied Electromagnetism and Photonics

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018).
(Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: María Concepción Santos Blanco
Others: Dios Otin, Victor Federico

Opening hours
Timetable: By agreement

Prior skills

Degree competences to which the subject contributes
Basic:
CB2. (ENG) GREELEC: Que els estudiants sàpiguen aplicar els coneixements adquirits al seu treball o vocació d'una forma professional i tinguin las competències que solen desmostrar-se per mitjà de l'elaboració i defensa d'arguments i la resolució de problemes dins de la seva àrea d'estudi.

Specific:
CE3. (ENG) GREELEC: Comprensió i domibbi dels conceptes bàsics sobre les lleis generals de la macànica, termodinàmica, camps i ones i electromagnetisme i la seva aplicació per a la resolució de problemes propis de l'enginyeria. (Mòdul de formació bàsica).

General:
CG5. (ENG) GREELEC: Coneixements per a la realització de medicions, càlculs, taxacions, peritacions, estudis, informes, planificació de tasques i treballs anàlegs en l'ambit específic de la telecomunicació.

Teaching methodology
The course provides a general view of the nature of electromagnetic waves, the characteristics of their propagation, both in free space as in guides and fibers, and their interaction with material media, dielectrics and conductors. There is a rich range of phenomena that are at the base of current technologies related to the transmission of information and of sensors and user interfaces. It is intended to give a fundamentally practical vision, but without neglecting a sufficiently general mathematical description, as to allow the student to understand the operating principles of other emerging technologies. The course is complemented by an introductory explanation to laser emitters and photodetection. Explanations are combined in the classic exhibition format, classes with transparencies, proposed exercises and laboratory work in which students have to obtain or confirm results by combining the experimental measures with the theory learned.
Learning objectives of the subject

The basic objective is for students to be able to express, in an appropriate physical-mathematical language, situations that may be related to the propagation, reflection, transmission, diffraction or guidance of electromagnetic waves, as well as the various wave interference problems that may be encountered.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>52h</th>
<th>34.67%</th>
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<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>8.67%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>85h</td>
<td>56.67%</td>
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# Content

<table>
<thead>
<tr>
<th>Topic</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plane wave polarization</strong></td>
<td><strong>9h</strong></td>
<td>Polarization types and mathematical description. Orthogonal polarizations. Devices for polarization control.</td>
</tr>
<tr>
<td><strong>Waveguides</strong></td>
<td><strong>8h</strong></td>
<td>Waveguides and transmission lines. Waveguides with metallic walls. Propagation modes. Modes TE and TM. Dispersion equation. Fundamental mode. Dielectric waveguides.</td>
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</tbody>
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**Description:**
- Wave equation. Types of electromagnetic waves. Permanent sine wave regime and phasor notation. Plane waves.
- Wave number. Characteristic relationships. Poynting vector.
- Polarization types and mathematical description. Orthogonal polarizations. Devices for polarization control.
Continuous evaluation: 30%
Laboratory practices (compulsory): 10%
Final exam: 60%

Resolution of problems related to the topics studied. The standards are the general ones at the UPC.

Radiation fundamentals

<table>
<thead>
<tr>
<th>Learning time: 7h</th>
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<tbody>
<tr>
<td>Theory classes: 7h</td>
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**Description:**

Optical detection

<table>
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<tr>
<th>Learning time: 7h</th>
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<tr>
<td>Theory classes: 6h</td>
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<tr>
<td>Laboratory classes: 1h</td>
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**Description:**

Laser fundamentals

<table>
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<th>Learning time: 6h</th>
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<tbody>
<tr>
<td>Theory classes: 6h</td>
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**Description:**

Qualification system

Regulations for carrying out activities

Bibliography

**Basic:**
