## Degree competences to which the subject contributes

### Specific:
- CE2. Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.
- CE11. Knowledge of hardware description languages for high-complex circuits.
- CE13. Ability to apply advanced knowledge in photonics, optoelectronics and high-frequency electronic
- CE15. Ability to integrate Telecommunication Engineering technologies and systems, as a generalist, and in broader and multidisciplinary contexts, such as bioengineering, photovoltaic conversion, nanotechnology and telemedicine.
- CE5. Ability to design radio-navigation and location systems, as well as radar systems.

### Transversal:
- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
- CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

## Teaching methodology

Being a laboratory course there are not formal lectures and learning is acquired through practice. Initially the assignments are guided and at the end more freedom of action are allowed to the students.
The student will learn how to design, characterize and measure the different devices that constitute a system that uses antennae, microwave circuits and optical devices. From these knowledge, the student would face the integration of the different elements conforming the system as well as its characterization, validation and practical application.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
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<tbody>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
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<td>0.00%</td>
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<tr>
<td>Hours small group:</td>
<td>39h</td>
<td></td>
<td>31.20%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
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<tr>
<td>Self study:</td>
<td>86h</td>
<td></td>
<td>68.80%</td>
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</tbody>
</table>
## Content

| **Microwave Circuitry Design and Simulation (I)** | **Learning time:** 3h  
Guided activities: 3h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Design and simulation of passive circuits (mixers and filters) with ADS and Momentum linked with the systems to implement at the end of the course.</td>
<td></td>
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</tbody>
</table>

| **Microwave Circuitry Design and Simulation (II)** | **Learning time:** 3h  
Guided activities: 3h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Design and simulation of passive circuits (mixers and filters) with ADS and Momentum linked with the systems to implement at the end of the course.</td>
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</tbody>
</table>

| **Antenna Design and Simulation** | **Learning time:** 3h  
Guided activities: 3h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Design and simulation of antennas linked with the systems to implement at the end of the course.</td>
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</tbody>
</table>

| **Antenna Measurement** | **Learning time:** 3h  
Guided activities: 3h |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Description:</strong> Measurement antenna techniques. First the students will use the anechoic chamber located at building D3 to characterize and antenna. The data will be later processed using the transformation near to far-field in order to determine its radiation pattern and gain.</td>
<td></td>
</tr>
</tbody>
</table>

| **Advanced use of Vector Network Analyzers (VNA)** | **Learning time:** 3h  
Guided activities: 3h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Advanced measurement techniques with VNA.</td>
<td></td>
</tr>
</tbody>
</table>
## Advanced use of Spectrum Analyzers (SA)

**Description:**
Advanced measurement techniques with Spectrum Analyzers (SA).

**Learning time:** 3h
- Guided activities: 3h

## Advanced use of Optical Spectrum Analyzers (OSA)

**Description:**

**Learning time:** 3h
- Theory classes: 3h

## Systems implementation

**Description:**
Building, assembling, testing and validation of systems.
The different groups would select one system among this list: radar systems and processing, radio over fiber, phase arrays with optical shifters, optical telemeter and distributed antenna systems.
Due to the obvious time constrains most of the devices will be comercial or already mounted. Only few of them will be mounted by the students. Most of the work will concéntrate on the modules integration and system testing and performance evaluation.

**Learning time:** 12h
- Theory classes: 12h

## Final report presentations

**Description:**
Presentation of the final report with the system implementes by each group of students.

**Learning time:** 3h
- Laboratory classes: 3h

## Photonics Systems Design

**Description:**

**Learning time:** 3h
- Guided activities: 3h