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.

Transversal:
- CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
- 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.

Learning objectives of the subject

- Present the mobile communications systems that compose the so-called 5th Generation (5G) resulting from the evolution of LTE technology and the integration of the new radio interface (5G New Radio).
- Analyze the characteristics and functionalities of 5G systems to provide services to new application domains, such as Internet of Things, vehicular communications, etc.

Learning results of the subject:
- Ability to analyse, model and design and implement the newest architectures, protocols and communication interfaces for mobile communication systems.
- Ability to analyse, model and apply advanced mobile communication techniques.

(Note: Until the course 2017/18 this subject was offered under the title “Advanced Mobile Communications” and it has
evolved to incorporate the 5G systems.)

**Study load**

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 125h</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>39h</td>
</tr>
<tr>
<td>Self study:</td>
<td>86h</td>
</tr>
</tbody>
</table>

31.20% 68.80%
## Content

### 1.- Introduction

**Description:**
- 1.1.- Mobile Communications technology evolution
- 1.2.- Drivers to increase network capacity
- 1.3.- 5G requirements and use cases
- 1.4.- Standardisation process

**Learning time:** 8h
- Theory classes: 3h
- Self study: 5h

### 2.- Long Term Evolution (LTE)

**Description:**
- 2.1.- Architecture
- 2.2.- Procedures
- 2.3.- Radio interface
- 2.4.- LTE-Advanced (LTE-A)

**Learning time:** 46h
- Theory classes: 14h
- Self study: 32h

### 3.- LTE evolution towards 5G

**Description:**
- 3.1.- LTE Advanced Pro
- 3.2.- Support for IoT
- 3.3.- Vehicular communications (V2X)
- 3.4.- eMBMS

**Learning time:** 22h
- Theory classes: 7h
- Self study: 15h

### 4.- 5G system

**Description:**
- 4.1.- Reference architecture
- 4.2.- Network functions and interfaces of the 5G Core
- 4.3.- NG-RAN
- 4.4.- QoS model and procedures
- 4.5.- Support for Network Slicing

**Learning time:** 22h
- Theory classes: 7h
- Self study: 15h
5G New Radio (5G NR)

Description:
- 5.1.- Radio interface protocol stack
- 5.2.- Physical layer characteristics
- 5.3.- Logical, transport and physical channels
- 5.4.- Procedures

Learning time: 27h
- Theory classes: 8h
- Self study: 19h

Qualification system

Team work: 25%
Mid-term exam: 30%
Final exam: 45%

Bibliography

Basic:

Complementary:

Others resources:
- Slides of the subject