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.

Teaching methodology

- Lectures
- Team work
- Oral presentations
- Mid-term exam
- Final exam

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.)

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Self study:</th>
</tr>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>39h</td>
<td>86h</td>
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<tr>
<td></td>
<td>31.20%</td>
<td>68.80%</td>
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</table>
# 230709 - 5GMCS - 5g Mobile Communications Systems

## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
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</table>
| **1.- Introduction**                                                   | 8h            | **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 |
| **2.- Long Term Evolution (LTE)**                                      | 46h           | **Description:**  
|                                                                         |               | 2.1.- Architecture  
|                                                                         |               | 2.2.- Procedures  
|                                                                         |               | 2.3.- Radio interface  
|                                                                         |               | 2.4.- LTE-Advanced (LTE-A)  
| **3.- LTE evolution towards 5G**                                       | 22h           | **Description:**  
|                                                                         |               | 3.1.- LTE Advanced Pro  
|                                                                         |               | 3.2.- Support for IoT  
|                                                                         |               | 3.3.- Vehicular communications (V2X)  
|                                                                         |               | 3.4.- eMBMS  
| **4.- 5G system**                                                      | 22h           | **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  

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**Description:**
- **Learning time:** 8h  
  - Theory classes: 3h  
  - Self study: 5h
- **Learning time:** 46h  
  - Theory classes: 14h  
  - Self study: 32h
- **Learning time:** 22h  
  - Theory classes: 7h  
  - Self study: 15h
- **Learning time:** 22h  
  - Theory classes: 7h  
  - Self study: 15h
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5.- 5G New Radio (5G NR)  

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>5.1.- Radio interface protocol stack</td>
</tr>
<tr>
<td>5.2.- Physical layer characteristics</td>
</tr>
<tr>
<td>5.3.- Logical, transport and physical channels</td>
</tr>
<tr>
<td>5.4.- Procedures</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Learning time: 27h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td>Self study: 19h</td>
</tr>
</tbody>
</table>

Qualification system

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

Bibliography

Basic:


Complementary:


Others resources:

Slides of the subject