230709 - 5GMCS - 5G Mobile Communications Systems

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications
Academic year: 2019
Degree: MASTER’S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019).
(Teaching unit Optional)
MASTER’S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5  Teaching languages: English

Teaching staff
Coordinator: Perez Romero, Jorge
Others: Perez Romero, Jorge

Prior skills
Basic knowledge of wireless communications

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.
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(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>Total learning time: 125h</th>
<th>Hours large group: 39h</th>
<th>31.20%</th>
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<tbody>
<tr>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
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## Content

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<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
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<tr>
<td>1.- Introduction</td>
<td>8h</td>
<td>Theory classes: 3h  Self study: 5h</td>
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<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>1.1. Mobile Communications technology evolution  1.2. Drivers to increase network capacity  1.3. 5G requirements and use cases  1.4. Standardisation process</td>
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<tr>
<td>2.- Long Term Evolution (LTE)</td>
<td>46h</td>
<td>Theory classes: 14h  Self study: 32h</td>
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<tr>
<td><strong>Description:</strong></td>
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<td>2.1. Architecture  2.2. Procedures  2.3. Radio interface  2.4. LTE-Advanced (LTE-A)</td>
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<tr>
<td>3.- LTE evolution towards 5G</td>
<td>22h</td>
<td>Theory classes: 7h  Self study: 15h</td>
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<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>3.1. LTE Advanced Pro  3.2. Support for IoT  3.3. Vehicular communications (V2X)  3.4. eMBMS</td>
</tr>
<tr>
<td>4.- 5G system</td>
<td>22h</td>
<td>Theory classes: 7h  Self study: 15h</td>
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<tr>
<td><strong>Description:</strong></td>
<td></td>
<td>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</td>
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5. 5G New Radio (5G NR)

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