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.)

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 125h</th>
<th>Hours large group: 39h</th>
<th>31.20%</th>
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<tr>
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<td>Self study: 86h</td>
<td>68.80%</td>
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## Content

### 1.- Introduction

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

**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)

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

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

### 3.- LTE evolution towards 5G

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

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

### 4.- 5G system

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

**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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### 5.- 5G New Radio (5G NR)

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 27h</th>
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<tbody>
<tr>
<td>5.1.- Radio interface protocol stack</td>
<td>Theory classes: 8h</td>
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<tr>
<td>5.2.- Physical layer characteristics</td>
<td>Self study : 19h</td>
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<tr>
<td>5.3.- Logical, transport and physical channels</td>
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<tr>
<td>5.4.- Procedures</td>
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### Qualification system

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

### Bibliography

**Basic:**


**Complementary:**


**Others resources:**

- Slides of the subject