230612 - AMC - Advanced Mobile Communications

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 TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff
Coordinator: Jordi Pérez Romero
Others: Ramon Ferrús, Jordi Pérez Romero, Ferran Casadevall

Prior skills
Basic knowledge about radiocommunications.

Degree competences to which the subject contributes

Specific:
1. Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.
2. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

Transversal:
3. 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.
4. 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
- Group work
- Oral presentations
- Mid-term exam
- Final exam

Learning objectives of the subject

Provide a system view of mobile communications networks through the description and analysis of the UMTS, LTE and LTE-Advanced networks.

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.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong></td>
<td>39h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>86h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31.20%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>68.80%</td>
</tr>
</tbody>
</table>
230612 - AMC - Advanced Mobile Communications

### Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Learning time: 6h</th>
</tr>
</thead>
</table>
| 1.- Introduction | 1.1.- Mobile Communications technology evolution  
1.2.- Standardisation process  
1.3.- Drivers to increase network capacity | Theory classes: 2h  
Self study : 4h |

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Learning time: 45h</th>
</tr>
</thead>
</table>
| 2.- 3G technologies (UMTS/ HSPA/ HSPA+) | 2.1.- UMTS standardisation  
2.2.- UMTS architecture  
2.2.1.- UMTS Radio Access Network (UTRAN)  
2.3.- UMTS R99 Radio Interface  
2.3.1.- Basic features  
2.3.2.- Protocol stack  
2.3.3.- Physical layer  
2.3.4.- Examples of channel configurations  
2.3.5.- Basic procedures  
2.4.- HSPA  
2.4.1.- HSDPA  
2.4.2.- HSUPA  
2.4.3.- Comparison HSDPA vs HSUPA  
2.5.- HSPA+  
2.5.1.- Evolution of HSPA  
2.5.2.- Main characteristics  
2.5.3.- HSPA+ features | Theory classes: 14h  
Self study : 31h |
# 3.- Long Term Evolution (LTE)

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 52h</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.- LTE standardisation</td>
<td>Theory classes: 16h</td>
</tr>
<tr>
<td>3.2.- LTE architecture</td>
<td>Self study: 36h</td>
</tr>
<tr>
<td>3.2.1.- Evolved Packet System (EPS)</td>
<td></td>
</tr>
<tr>
<td>3.2.2.- User Equipment (UE)</td>
<td></td>
</tr>
<tr>
<td>3.2.3.- E-UTRAN</td>
<td></td>
</tr>
<tr>
<td>3.2.4.- Evolved Packet Core (EPC)</td>
<td></td>
</tr>
<tr>
<td>3.3.- LTE procedures</td>
<td></td>
</tr>
<tr>
<td>3.3.1.- Session management</td>
<td></td>
</tr>
<tr>
<td>3.3.2.- Mobility management</td>
<td></td>
</tr>
<tr>
<td>3.3.3.- Signalling flows</td>
<td></td>
</tr>
<tr>
<td>3.4.- LTE radio interface</td>
<td></td>
</tr>
<tr>
<td>3.4.1.- Physical layer</td>
<td></td>
</tr>
<tr>
<td>3.4.2.- Logical, transport and physical channels</td>
<td></td>
</tr>
<tr>
<td>3.4.3.- DL Physical channels</td>
<td></td>
</tr>
<tr>
<td>3.4.4.- UL Physical channels</td>
<td></td>
</tr>
<tr>
<td>3.4.5.- Voice over LTE (VoLTE)</td>
<td></td>
</tr>
<tr>
<td>3.4.6.- Procedures</td>
<td></td>
</tr>
<tr>
<td>3.5.- MBMS</td>
<td></td>
</tr>
<tr>
<td>3.5.1.- Concept</td>
<td></td>
</tr>
<tr>
<td>3.5.2.- Single Frequency Network (SFN)</td>
<td></td>
</tr>
<tr>
<td>3.5.3.- MBMS Areas</td>
<td></td>
</tr>
<tr>
<td>3.5.4.- MBMS Architecture</td>
<td></td>
</tr>
<tr>
<td>3.5.5.- Logical, transport and physical channels</td>
<td></td>
</tr>
<tr>
<td>3.5.6.- Physical resources used in MBSFN</td>
<td></td>
</tr>
</tbody>
</table>
4.- LTE-Advanced (LTE-A), LTE-A Pro and way towards 5G

**Description:**

4.1.- LTE Advanced  
4.1.1.- Introduction  
4.1.2.- Carrier Aggregation  
4.1.3.- Enhanced multi-antenna techniques  
4.1.4.- CoMP  
4.1.5.- Relaying  
4.1.6.- Heterogeneous Networks  
4.2.- LTE Advanced Pro  
4.2.1.- Introduction  
4.2.2.- Massive Carrier Aggregation  
4.2.3.- Dual Connectivity  
4.2.4.- Licensed-Assisted Access (LAA)  
4.2.5.- LTE-Wi-Fi Aggregation (LWA)  
4.2.6.- Support for IoT  
4.2.7.- Device-to-Device (D2D) communications  
4.3.- Towards 5G  
4.3.1.- Use cases  
4.3.2.- Requirements  
4.3.3.- Technologies  
4.3.4.- Organisations  

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

**Qualification system**

Group work (written report and oral presentation): 25%  
Mid-term exam: 30%  
Final exam: 45%
Bibliography

Basic:


Complementary:


Others resources:

Collection of slides