Course guides
230612 - AMC - Advanced Mobile Communications

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).
Academic year: 2019 ECTS Credits: 5.0 Languages: English

LECTURER
Coordinating lecturer: 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>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>39</td>
<td>31.20</td>
</tr>
<tr>
<td>Self study</td>
<td>86</td>
<td>68.80</td>
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</tbody>
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Total learning time: 125 h
CONTENTS

1.- Introduction

Description:
1.1.- Mobile Communications technology evolution
1.2.- Standardisation process
1.3.- Drivers to increase network capacity

Full-or-part-time: 6 h
Theory classes: 2h
Self study: 4h

2.- 3G technologies (UMTS/HSPA/HSPA+)

Description:
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

Full-or-part-time: 45 h
Theory classes: 14h
Self study: 31h

3.- Long Term Evolution (LTE)

Description:
3.1.- LTE standardisation
3.2.- LTE architecture
3.2.1.- Evolved Packet System (EPS)
3.2.2.- User Equipment (UE)
3.2.3.- E-UTRAN
3.2.4.- Evolved Packet Core (EPC)
3.3.- LTE procedures
3.3.1.- Session management
3.3.2.- Mobility management
3.3.3.- Signalling flows
3.4.- LTE radio interface
3.4.1.- Physical layer
3.4.2.- Logical, transport and physical channels
3.4.3.- DL Physical channels
3.4.4.- UL Physical channels
3.4.5.- Voice over LTE (VoLTE)
3.5.- MBMS
3.5.1.- Concept
3.5.2.- Single Frequency Network (SFN)
3.5.3.- MBMS Areas
3.5.4.- MBMS Architecture
3.5.5.- Logical, transport and physical channels
3.5.6.- Physical resources used in MBSFN

Full-or-part-time: 52 h
Theory classes: 16h
Self study: 36h

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
4.3.- Device-to-Device (D2D) communications
4.3.1.- Towards 5G
4.3.2.- Use cases
4.3.3.- Requirements
4.3.4.- Technologies

Full-or-part-time: 22 h
Theory classes: 7h
Self study: 15h

GRADING SYSTEM

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

Basic:

Complementary:

RESOURCES

Other resources:
Collection of slides