



Course guide

230612 - AMC - Advanced Mobile Communications

Last modified: 06/05/2019

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: **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

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	39,0	31.20

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: 6h

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: 45h

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)
 - 3.4.6.- Procedures
- 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: 52h

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
 - 4.2.7.- 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

Full-or-part-time: 22h

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:

- Holma, H.; Toskala, A. (eds.). WCDMA for UMTS - HSPA evolution and LTE. 5th ed. Chichester: John Wiley & Sons, 2010. ISBN 9780470686461.
- Holma, H.; Toskala, A. (eds.). LTE for UMTS: evolution to LTE-Advanced. Chichester, UK: John Wiley and Sons, 2011. ISBN 9780470660003.
- Dahlman, E.; Parkvall, S.; Skold, J.; Beming, P. 3G evolution: HSPA and LTE for mobile broadband. 2nd ed. Amsterdam: Elsevier, 2008. ISBN 9780123745385.
- Agustí, R. [et al.]. LTE: nuevas tendencias en comunicaciones móviles [on line]. [S.I.]: Fundación Vodafone, 2010 [Consultation: 02/05/2020]. Available on: <https://proyectolte.files.wordpress.com/2012/09/lte-nuevas-tendencias.pdf>. ISBN 8493474045.

Complementary:

- Sallent, O.; Pérez, J. Fundamentos de diseño y gestión de sistemas de comunicaciones móviles celulares [on line]. Barcelona: Universitat Politècnica de Catalunya. Iniciativa Digital Politècnica, 2014 [Consultation: 10/10/2018]. Available on: <http://hdl.handle.net/2099.3/36630>. ISBN 9788498804812.
- Olsson, M. [et al.]. SAE and the evolved packet core: driving the mobile broadband revolution. Oxford: Academic Press, 2009. ISBN 9780123748263.
- Holma, H.; Toskala, A. HSDPA/HSUPA for UMTS: high speed radio access for mobile communications. Chichester: John Wiley & Sons, 2006. ISBN 0470018844.



RESOURCES

Other resources:

Collection of slides