Course guides
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: 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

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

Total learning time: 125 h

CONTENTS

1.- Introduction

Description:
1.1.- Mobile Communications technology evolution1.2.- Standardisation process1.3.- 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 standardisation2.2.- UMTS architecture2.2.1.- UMTS Radio Access Network (UTRAN)2.3.- UMTS R99 Radio Interface2.3.1.- Basic features2.3.2.- Protocol stack2.3.3.- Physical layer2.3.4.- Examples of channel configurations2.3.5.- Basic procedures2.4.- HSPA2.4.1.- HSDPA2.4.2.- HSUPA2.4.3.- Comparison HSDPA vs HSUPA2.5.- HSPA+2.5.1.- Evolution of HSPA2.5.2.- Main characteristics2.5.3.- HSPA+ features

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

3.- Long Term Evolution (LTE)

Description:
3.1.- LTE standardisation3.2.- LTE architecture3.2.1.- Evolved Packet System (EPS)3.2.2.- User Equipment (UE)3.2.3.- E-UTRAN3.2.4.- Evolved Packet Core (EPC)3.3.- LTE procedures3.3.1.- Session management3.3.2.- Mobility management3.3.3.- Signalling flows3.4.- LTE radio interface3.4.1.- Physical layer3.4.2.- Logical, transport and physical channels3.4.3.- DL Physical channels3.4.4.- UL Physical channels3.4.5.- Voice over LTE (VoLTE)3.4.6.- Procedures3.5.- MBMS3.5.1.- Concept3.5.2.- Single Frequency Network (SFN)3.5.3.- MBMS Areas3.5.4.- MBMS Architecture3.5.5.- Logical, transport and physical channels3.5.6.- 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 Advanced4.1.1.- Introduction4.1.2.- Carrier Aggregation4.1.3.- Enhanced multi-antenna techniques4.1.4.- CoMP4.1.5.- Relaying4.1.6.- Heterogeneous Networks4.2.- LTE Advanced Pro4.2.1.- Introduction4.2.2.- Massive Carrier Aggregation4.2.3.- Dual Connectivity4.2.4.- Licensed-Assisted Access (LAA)4.2.5.- LTE-Wi-Fi Aggregation (LWA)4.2.6.- Support for IoT4.2.7.- Device-to-Device (D2D) communications4.3.- Towards 5G4.3.1.- Use cases4.3.2.- Requirements4.3.3.- Technologies4.3.4.- Organisations

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:
- 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.l.]: 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