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230689 - WLAB - Wireless Laboratory

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: Anna Umbert Juliana

Others: Anna Umbert, Ramon Ferrús, Ferran Casadevall, Jordi Pérez-Romero

Requirements

Co-requirements: "Advanced Mobile Communications" for MET and "Mobile Communication Systems" for WICOM

Degree competences to which the subject contributes

Specific:

CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.
CE3. Ability to implement wired/wireless systems, in both fix and mobile communication environments.

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.
CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
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.

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Teaching methodology

- Laboratory classes
- Laboratory practical work
- Individual work (distance)
- Extended answer test (Final Exam)

Planning of activities:

Laboratory :
- Description: Practices with commercial test equipment and software to work the different contents of LTE systems.

Exercises:
- Description: Exercises to strengthen the theoretical knowledge, before attending the laboratory, to prepare for practices.

Extended answer test (Final examination):
- Description: Final evaluation test with questions and short exercises, to check that they have reached the concepts introduced in practices.

Learning objectives of the subject

Learning objectives of the subject:
The aim of this course is to train students in wireless technologies by using planning and optimization tools, drive-test tools, radio-testers, or wireless communications simulation platforms. At the end of the course, the student must be able to measure the most relevant parameters of radio access networks and evaluate the system performances of mobile communications systems, with especial emphasis in LTE technology.

Learning results of the subject:
- Learn to use equipment for measuring physical layer parameters of radio communications systems including instrumentation equipment for functional analysis of terminals, and communication networks.
- Acquire a practical working knowledge of key technologies and mobile communications systems, mainly LTE (4G) technology
- Develop the ability to identify, analyze and solve engineering problems in the context of mobile communications systems.
- Develop the ability to perform simulations or experiments and evaluate the results by comparing theoretical and experimental results and evaluate performance of radio communications systems in controlled and / or real environments.
- Learning to use commercial tools for planning, design and performance analysis of mobile communication systems.

Study load

Total learning time: 125h	Hours small group:	39h	31.20%
	Self study:	86h	68.80%

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Content

Course Introduction

Learning time: 5h

Theory classes: 3h
Self study : 2h

Description:
- Presentation of the different areas
- Laboratory organisation (equipment, tools, location,?)
- Groups and schedule

Area#1. Planning and optimisation of LTE networks

Learning time: 40h

Laboratory classes: 12h
Self study : 28h

Description:
Create a nominal plan for an LTE access network in a given real environment
- Geographical information and its management
- Socio-economic issues (types of users, #inhabitants,...)
- Existing technical requirements (ITU, 3GPP, IEEE recommendations)
- Technical issues (power budget calculations, propagation model,...)
- Develop LTE network with ATOLL (create network, analyse coverage, analyse capacity, ...)
- Optimisation

Area#2. Drive test

Learning time: 40h

Laboratory classes: 12h
Self study : 28h

Description:
Monitoring real LTE mobile networks with Qualipoc and analysis tools
- Introduction to monitoring tools
- Configuration parameters of 4G (LTE) systems
- Network Signalling / basic procedures
- Drive tests
- Post processing work

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Area#3. Experimental implementation and testing of LTE radio interface	Learning time: 40h Laboratory classes: 12h Self study : 28h

Description:
- LTE Downlink Structure
- Synchronization and Signal Acquisition
- MIMO
- Link Adaptation
- Downlink/Uplink Resource Allocation

Qualification system

Final examination (Short answer test): 15%
Exercises (Previous works): 15%
Laboratory assessments (Finals reports): 60%
Individual assessment (attendance, attitude,...) 10%

Bibliography

Basic:

Holma, Harri; Toskala, Antti. LTE for UMTS : evolution to LTE-Advanced. 2nd ed. Chichester, UK: John Wiley, 2011. ISBN 9780470660003.

Chris Johnson. Long Term Evolution in Bullets. 2nd edition. Createspace, 2012. ISBN 9781478166177.

Complementary:

Agustí Comes, Ramon. LTE : nuevas tendencias en comunicaciones móviles. [S.l.]: Fundación Vodafone, 2010. ISBN 8493474045.

Sallent Roig, Oriol; Pérez Romero, Jordi. Fundamentos de diseño y gestión de sistemas de comunicaciones móviles celulares [on line]. Barcelona: Universitat Politècnica de Catalunya. Iniciativa Digital Politècnica, 2014 [Consultation: 15/09/2015]. Available on: <http://hdl.handle.net/2099.3/36630>. ISBN 9788498804812.