

Academic Year: ( 2023 / 2024 )

Review date: 27-04-2023

Department assigned to the subject: Signal and Communications Theory Department

Coordinating teacher: GARCIA ARMADA, ANA

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

Not applicable

**OBJECTIVES**

Mobile communications are a motor of the economy and have experienced revolutionary changes. It is foreseen that this revolution will continue. The number of mobile services users has reached the population of our planet and the forecast is that in less than five years the mobile traffic will multiply by ten. This will be possible through a new generation of technologies and services, what constitutes a challenge and an opportunity.

The goal of this subject is to provide the students with the capabilities to work and foster the mobile communications sector in Spain and Europe. The students will acquire the following capabilities:

- Knowledge of the principles, technologies and architectures that configure the mobile communications systems able to provide:
  - o broadband communications
  - o machine-type communications and the internet of things (MTC, IoT)
  - o high reliability and low latency communications
- Knowledge of the main mobile communication systems.
- Capability to analyze, design and plan complete mobile systems according to some fundamental quality parameters.
- Knowledge of the design and planning of these systems by solving real cases proposed by an operator.
- Familiarity with the simulation software and hardware instrumentation used in these systems through real measurements and problems.

**DESCRIPTION OF CONTENTS: PROGRAMME**

1. Introduction
  - Origin and evolution of mobile systems: the mobile generations and their adaptation to the service demands.
  - Review of basic concepts
  - 1 G and 2G systems
2. Technologies and architectures for mobile communications
  - Spread spectrum and OFDM
  - Multi-antenna techniques (MIMO)
  - Heterogeneous networks and base station coordination
  - Evolution of the architecture
3. Characteristics and planning of today's mobile communications systems
  - 2.5G systems.
  - 3G systems and their evolution: UMTS and HSPA
  - LTE and LTE-A
  - Machine-type communications (MTC) and technologies for the Internet of Things (IoT)
4. Practical case
  - Problem definition with help of a mobile operator
  - Work in groups
  - Presentation of the results to the class and the operator
5. Introduction to 5G
  - New requirements and standardization
  - New technologies: massive MIMO, mobile communications at millimeter waves, software defined networks (SDN)

## LEARNING ACTIVITIES AND METHODOLOGY

Three learning activities are proposed, namely, theoretical clases, practical simulations and lab classes and a practical study case to be defined with the help of a mobile operator

Due to space restrictions in the laboratory, it is possible that some practical sessions will be established outside the usual timetable of the subject.

## ASSESSMENT SYSTEM

The final mark is obtained as a weighted sum of the marks of the participation in class, problem solving, practical case and laboratory work.

|                                                                            |     |
|----------------------------------------------------------------------------|-----|
| <b>% end-of-term-examination:</b>                                          | 0   |
| <b>% of continuous assessment (assigments, laboratory, practicals...):</b> | 100 |

## BASIC BIBLIOGRAPHY

- H. HOLMA, A. TOSKALA WCDMA for UMTS, John Wiley & Sons, Ltd, 2000
- H. Holma and A. Toskala LTE for UMTS: Evolution to LTE-Advanced, John Wiley & Sons, Ltd., 2011
- T. HALONEN, J. ROMERO, J. MELERO GSM, GPRS AND EDGE performance. Evolution towards 3G/UMTS, John Wiley & Sons, Ltd, 2002
- T. S. RAPPAPORT Wireless communications: Principles and Practice., Prentice Hall, 2002

## ADDITIONAL BIBLIOGRAPHY

- M. MOULY, M-B PAUTET GSM System for Mobile Communications, Ed. Cell & Sys, 1992
- RAMJEE PRASAD Universal Wireless Personal Communications, Artech House, 1998

## BASIC ELECTRONIC RESOURCES

- . 3GPP Especifications: <http://www.3gpp.org/specifications>
- . 3GPP Releases: <http://www.3gpp.org/Releases>