

Academic Year: (2024 / 2025)

Review date: 17-01-2025

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

LEARNING OUTCOMES

CB1: Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study

CB2: Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CG1: Ability to write, develop and sign projects in the area of telecommunications engineering aimed at the design, development and utilization of telecommunications and electronic networks, services and applications, in accordance with the competences acquired in the degree program, as set out in Section 5 of OM CIN 352/2009.

CG3: Knowledge of basic and technological subject areas which enable acquisition of new methods and technologies, as well as endowing the technical engineer with the versatility necessary to adapt to any new situation.

ETEGITT1: Ability to construct, use and manage telecommunication networks, services, processes and applications, such as systems for capture, transport, representation, processing, storage, and multimedia information presentation and management, from the point of view of transmission systems.

RA1: Knowledge and understanding of the general fundamentals of engineering, scientific and mathematical principles, as well as those of their branch or specialty, including some knowledge at the forefront of their field.

RA3: Design. Graduates will have the ability to make engineering designs according to their level of knowledge and understanding, working as a team. Design encompasses devices, processes, methods and objects, and specifications that are broader than strictly technical, including social awareness, health and safety, environmental and commercial considerations

RA5: Applications. Graduates will have the ability to apply their knowledge and understanding to solve problems, conduct research, and design engineering devices or processes. These skills include knowledge, use and limitations of materials, computer models, process engineering, equipment, practical work, technical literature and information sources. They must be aware of all the implications of engineering practice: ethical, environmental, commercial and industrial.

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 classes, 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

% end-of-term-examination:	0
% of continuous assessment (assignments, laboratory, practicals...):	100

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

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>