

## 60957 - Heterogeneous networks

### Syllabus Information

**Academic year:** 2023/24

**Subject:** 60957 - Heterogeneous networks

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 623 - Master's Degree in Telecommunications Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The general objective of this subject is that the student learns about the technologies on which the new mobile/wireless communications systems are based, with emphasis on heterogeneous mono and multi-technology network deployment configurations. Specifically, to know the basics of communication protocols and basic procedures of this type of networks, of mechanisms for the provision of mobility services, quality of service, transport and dissemination of multimedia services, and to be able to plan and dimension these networks. These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>), specifically, they will contribute to the achievement of Objectives 9.5, 9.c, 9.1 of O9, 8.2 of O8 and 7.3, 7.b of O7.

### 2. Learning results

To understand the technological, regulatory, economic and business framework for the development of new access technologies and heterogeneous network architectures.

To know and understand the structure and operation of the radio interface of the new heterogeneous wireless communications networks, as well as their design principles.

To know and understand the design and evolution of heterogeneous network architectures, including the design principles of the different functions (mobility, routing and provision of multimedia services unicast, multicast, security) and the principles, mechanisms, procedures and protocols that regulate end-to-end transmission.

To know and apply radio resource and radio spectrum management techniques, including quality of service delivery strategies.

To know the guidelines for designing, sizing and planning the deployment and operation of multimedia services, processes and applications over heterogeneous networks.

-To know how to design and analyse heterogeneous network deployments in different application scenarios from a techno-economic point of view.

### 3. Syllabus

Block 0. Introduction. Overview of the mobile and wireless communications sector. Mobile radio access: principles of evolution and expansion.

Block 1. 4G mobile networks. Operator mobile network architecture models. Functional elements, interfaces and protocols. Basic procedures. Carrier management, sessions, mobility, multicast service provision. Radio interface and associated procedures. Quality of service, radio resource management and radio spectrum.

Block 2. Evolution of mobile networks and adaptations to new service contexts. 5G evolution. New scenarios of integration, interoperation and coexistence of wireless heterogeneous networks. Deployments for IoT solutions.

### 4. Academic activities

Master class. Presentation by the teacher of the main contents of the subject. 46 hours.

Problem solving and practical cases proposed by the teacher, with student participation. 14 hours

Supervised practical work. Students will solve practical cases by applying the techniques and procedures seen in the theoretical and problem sessions. 20 hours

### 5. Assessment system

It consists of the following evaluation activities:

Supervised works. They must be carried out by each student during the term. It will account for 10% of the final grade. A 4.5 out of 10 is required to pass the subject.

Mid-term exam. There will be a written test. It can include problem solving as well as theoretical and practical questions formulated as multiple-choice tests. It represents 40% of the final grade. Passing the exam with a grade of 4.5 out of 10 will

voluntarily exempt the student from taking this part of the final exam.

Final exam. It will consist of 2 parts. It can include problem solving as well as theoretical and practical questions formulated as multiple-choice tests.

Part one. It assesses the contents contemplated in the mid-term exam (40%)

Second part. It addresses the rest of the contents not covered in the mid-term exam. (50%). In case of not passing the tutored assignments, a group of extra questions will be included in the second part, and the whole will be assessed with 60% of the grade.

A minimum of 4.5 out of 10 in each part is required to pass the subject.

The student is entitled to a global test in each of the exams established throughout the academic year.