

Course guide

230054 - RCOMSISTEL - Radio Communications

Last modified: 24/05/2024

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE ORIOL SALLENTO ROIG

Others: Primer quadrimestre:
JOSE ORIOL SALLENTO ROIG - 10
IRENE VILÀ MUÑOZ - 10

Segon quadrimestre:
JOSE ORIOL SALLENTO ROIG - 40

REQUIREMENTS

COMUNICACIONS DIGITALS AVANÇADES - Corequisit
RADIACIÓ I PROPAGACIÓ - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Generical:

12 CPE N3. They will be able to identify, formulate and solve engineering problems in the ICC field and will know how to develop a method for analysing and solving problems that is systematic, critical and creative.

TEACHING METHODOLOGY

Lectures
Exercises and problems
Short answer tests (Control)
Long answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Objectives:

- Study the fundamentals of the communication systems that make use of the radioelectric spectrum as a support for the communication
- Study, design and evaluation of mobile communications systems, wireless systems and fixed radio links.

Result of the learning stage:

- To be able of designing and evaluating the techniques that constitute the basis for networks, services and telecommunication applications in mobile environments, wireless systems and radio link communications, from the perspective of the communications.
- To be able to identify and model complex radiocommunications systems.
- To understand the management process of the radioelectrical spectrum and the frequency allocation
- To carry out quantitative and qualitative analysis and to evaluate the influence of approximations
- To apply the acquired competence to carry out a task in an autonomous way
- To identify the need for continuous learning and to develop an own strategy to carry it out.

STUDY LOAD

Type	Hours	Percentage
Self study	85,0	56.67
Hours large group	65,0	43.33

Total learning time: 150 h

CONTENTS

1.- Introduction

Description:

- 1.1.- Definition
- 1.2.- Scope
- 1.3.- Mobile communications systems and technologies

Full-or-part-time: 4h

Theory classes: 2h

Self study : 2h

2.- Radio channel characterisation

Description:

- 2.1.- Introduction
- 2.2.- Propagation in mobile environments
 - 2.2.1.- Propagation losses
 - 2.2.2.- Slow fading
 - 2.2.3.- Multipath propagation
 - 2.2.3.1.- Proximity echoes: Fast fading
 - 2.2.3.2.- Distant echoes: distortion
 - 2.2.4.- Second order statistics
 - 2.2.5.- Measurements
- 2.3.- Propagación in fixed radio links
 - 2.3.1.- Propagation losses
 - 2.3.1.1.- Diffraction
 - 2.3.1.2.- Refraction
 - 2.3.1.3.- Antenna height
 - 2.3.2.- Attenuation due to rain
 - 2.3.3.- Fading due to refraction
- 2.4.- Noise
- 2.5.- Interference

Full-or-part-time: 23h

Theory classes: 10h

Self study : 13h

3.- Radio link budget

Description:

- 3.1.- Quality objectives
- 3.2.- Performance model of the radio channel
 - 3.2.1.- Gaussian channel
 - 3.2.2.- Rayleigh channel
- 3.3.- Power budget
 - 3.3.1.- Mobile systems
 - 3.3.2.- Fixed radio links
- 3.4.- Radio engineering techniques
 - 3.4.1.- Power control
 - 3.4.2.- Equalisation
 - 3.4.3.- Channel coding and interleaving
 - 3.4.4.- Adaptive coding and modulation
 - 3.4.5.- Diversity
 - 3.4.6.- Spatial multiplexing

Full-or-part-time: 37h

Theory classes: 16h

Self study : 21h

4.- Mobile radio access

Description:

- 4.1.- Introduction
- 4.2.- Multiple access techniques
 - 4.2.1.- FDMA
 - 4.2.2.- TDMA
 - 4.2.3.- CDMA
 - 4.2.4.- OFDMA
- 4.3.- Duplexing techniques
 - 4.3.1.- FDD
 - 4.3.2.- TDD
- 4.4.- Radio access management
 - 4.4.1.- TDMA access
 - 4.4.2.- CDMA access
 - 4.4.3.- OFDMA access

Full-or-part-time: 40h

Theory classes: 17h

Self study : 23h

5.- Cellular systems

Description:

- 5.1.- Model of a cellular system
- 5.2.- Control and management of cellular systems
- 5.3.- Dimensioning of a cellular system
- 5.4.- Dimensioning of FDMA/TDMA cellular systems
 - 5.4.1.- Deployment of resources
 - 5.4.2.- Traffic characterisation
 - 5.4.3.- Dimensioning process
- 5.5.- Dimensioning of CDMA cellular systems
 - 5.5.1.- Deployment of resources
 - 5.5.2.- Traffic characterisation
 - 5.5.3.- Dimensioning process
- 5.6.- Multi-layer cellular structures
- 5.7.- Radio resource management in cellular systems
 - 5.7.1.- FDMA/TDMA systems
 - 5.7.2.- CDMA systems
 - 5.7.3.- OFDMA systems

Full-or-part-time: 46h

Theory classes: 20h

Self study : 26h

GRADING SYSTEM

-60% Final Exam

-40% Control



BIBLIOGRAPHY

Basic:

- Sallent Roig, Oriol; Pérez Romero, Jordi. Fundamentos de diseño y gestión de sistemas de comunicaciones móviles celulares [online]. Barcelona: Iniciativa Digital Politécnica UPC, 2014 [Consultation: 02/10/2014]. Available on: <http://hdl.handle.net/2099.3/36630>. ISBN 9788498804812.

Complementary:

- Hernando Rábanos, J.M.; Riera Salís, J.M.; Mendo Tomás, L. Transmisión por radio. 7a ed. Madrid: Centro de Estudios Ramón Areces, 2013. ISBN 9788499611068.

RESOURCES

Other resources:

Radiocommunications: Slides

Radiocommunications: Exercises

Radiocommunications: Problems