

## Access Technologies

Code: 102697  
ECTS Credits: 6

Degree	Type	Year	Semester
2500898 Telecommunication Systems Engineering	OT	4	2

### Contact

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### Use of Languages

Principal working language: catalan (cat)  
Some groups entirely in English: Yes  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: Yes

### Teachers

Xavier Redon Hernandez

### Prerequisites

It is advisable to have completed the courses "Fundamentals of Communications" and "Digital Signal Processing".

### Objectives and Contextualisation

The course focuses on the study of access technologies, from the physical layer at the modulation level to the deployment of telecommunications networks at the infrastructure level. The objectives are:

1. To understand the general principles of operation of these technologies.
2. To design the corresponding schemes for transmission and reception.
3. To comprehend the restrictions of each technology in terms of available resources, in order to design efficient systems.
4. To know the basic characteristics of real systems, such as DVB-T/T2n, LTE or 5G
5. To understand the real problems of installation, operation and maintenance of access networks
6. To understand how is the spectrum managed
7. To understand the standardization processes necessary to implement these networks

### Competences

- Apply deterministic and stochastic signal processing techniques to the design of communication subsystems and data analysis.
- Apply the necessary legislation in the exercise of the telecommunications engineers profession and use the compulsory specifications, regulations and standards.
- Communication
- Design and dimension multiuser communication systems using the principles of communication theory under the restrictions imposed by the specifications and the need to provide a quality service.
- Develop personal work habits.
- Develop thinking habits.

- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Work in a team.

## Learning Outcomes

1. Apply signal processing techniques in order to improve the features of multiuser systems.
2. Assume and respect the role of the different members of a team, as well as the different levels of dependency in the team.
3. Build, exploit and manage telecommunications networks from the point of view of access technologies.
4. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
5. Develop critical thinking and reasoning.
6. Develop independent learning strategies.
7. Distinguish multiple access technologies based on digital signal processing techniques.
8. Evaluate the advantages and disadvantages of different technological options for the deployment or implementation of emerging communication systems.
9. Measure the features of different access technologies in terms of multiuser capacity.
10. Prevent and solve problems.
11. Use techniques based on telecommunication networks, services and applications both in fixed and mobile, and local or long distance environments with different bandwidths, including television and data.
12. Work autonomously.

## Content

1. Radio spectrum
  1. Bands and use of radio spectrum
  2. Regulation
  3. Spectrum regulation bodies
  4. World Radiocommunication Conference
2. Organismes d'estandardització
  1. Existing Standardization bodies
  2. Internal organization of standardization bodies
  3. Licencing models
3. Multicarrier modulations
  1. Multipath propagation
  2. Guard interval/cyclic prefix
  3. FFT based modulations
  4. Applications: WLAN, xDSL, DVB-T/T2, LTE
4. Use case: Mobile telephony (LTE and 5G)
  1. Mobile networks architecture
  2. 3GPP and its standards
  3. Improving coverage: Small Cells, Nano cells, DAS,...
5. Use case: TV broadcasting (DVB-T/T2,...)
  1. Spanish TV History
  2. TV Broadcasting architecture
  3. TV Encoding and multiplexing for SD, HD and UHD signals
  4. DVB-T and T2
  5. Distribution network
  6. Network planning
  7. Network O&M
6. Use case: Radio broadcasting (FM, DAB,...)
  1. Broadcast radio network architecture
  2. FM and AM broadcasting
  3. Digital radio modulations: DAB/DAB+, DRM/DRM+,...
7. Use case: IOT networks (NB-IoT, Sigfox, Lora,...)
  1. IoT service requirements

2. Existing solutions
3. Network model: dedicated vs shared
8. Use case: Critical communications networks (TETRA, LTE,...)
  1. Critical communications service requirements
  2. Existing solutions: Tetra, LTE, GSM-R
  3. Network model: dedicated vs shared

## Methodology

Activities:

- Master classes: exposition of theoretical contents and analysis of practical cases.
- Laboratory practices: application of the concepts and techniques presented to the master classes in different practical cases.
- Participatory activities such as a "brainstorm" session, contests, "role play", case resolution.

Autonomous activities:

- Study of the theoretical and practical contents of the subject.
- Completion of case planning and resolution exercises.
- Search of bibliography.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory	12	0.48	1, 4, 3, 6, 5, 7, 9, 10, 12, 11, 8
Master class	38	1.52	1, 5, 7, 9, 10, 11, 8
Type: Supervised			
Tutorships	2	0.08	1, 4, 3, 7, 9, 10, 11, 8
Type: Autonomous			
Individual work	80	3.2	1, 3, 6, 5, 7, 9, 10, 12, 11, 8

## Assessment

There will be two parts:

- 1) Exercises
- 2) Exam

Final qualification will be: 60% average of exercises + 40% exam (part 2)

After being qualified at least of 2 thirds of the total subject, the student will have the opportunity to have a final exam related to part 1 and 2. This exam will be after finishing the standard activities. In case the student does not attend this exam, won't be a second chance.

In case of failing to present 2 thirds of the evaluation activities the student will be considered unqualifiable.

Honors are decided by the professor of the subject only if final qualification is over 9.00 and no more than 5% of students can be awarded with this honors.

### Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Development and exercises presentation	60%	18	0.72	1, 2, 4, 3, 5, 7, 9, 10, 11, 8
Exam	40%	0	0	1, 3, 6, 5, 7, 9, 10, 12, 11, 8

### Bibliography

- M. Bonet, El imperio del aire, Ed. UOC, 2016
- Jose F Montserratm Mario García, Juan José Olmos, Narcís Cardona, 3GPP LTE-Advanced y su evolución hacia la 5G móvil