Course guide
300527 - CDIOIII - Cdio III

Last modified: 20/06/2026

Unit in charge: Castelldefels School of Telecommunications and Aerospace Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.
748 - FIS - Department of Physics.

Degree: BACHELOR'S DEGREE IN SATELLITE ENGINEERING (Syllabus 2024). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

S6 - Evaluate satellite systems, taking into account specifications, regulations, and mandatory standards. TYPE: Skills
S1 - Apply basic and advanced concepts to problems related to space engineering. TYPE: Skills
K1 - Identify basic tools used in the field of satellite engineering. TYPE: Knowledge
K3 - Identify the elements of telecommunications systems. TYPE: Knowledge
K4 - Identify the standards associated with satellite engineering, as well as the regulatory, social, ethical, environmental, commercial, operational, and technical and economic feasibility limitations. TYPE: Knowledge
S7 - Design a terrestrial-satellite and inter-satellite telecommunications network. TYPE: Skills
C2 - Carry out tasks and projects individually or as part of a group, assuming responsibilities. TYPE: Competencies

STUDY LOAD

Type	Hours	Percentage
Self study	70,0	56.00
Hours small group	55,0	44.00

Total learning time: 125 h

CONTENTS

SDR implementation of communications systems

Description:
Know everything you need to carry out the implementation and testing of a communication system based on the SDR concept.

Specific objectives:
The student must be able to define the processing chain that will make up the system, the restrictions that will be applied, its basic configuration and the tools and development environments that will be used for each of the modules that compose it.

• Know the SDR concept and its implications.
• Model the processing chain of a communications system based on the SDR approach in its implementation, discriminating between analog and digital functionalities.
• Know the channel on which the transmission will be carried out: a) Acoustic, b) RF, c) Light (LIFI, Laser).
• Know the transceivers used and their development tools.
• Know the computing platform and the tools and software environment for developing, executing and testing the software processing that must be done.

Related activities:
Introduction.
Processing chain of a communication system.
Analog/digital hardware platform.
Processor and development environment.
Measurement and test methodology.
Channel analysis.

Full-or-part-time: 45h
Laboratory classes: 20h
Self study : 25h

Channel modulation and coding

Description:
Identify and model the operation of "Modulation and Coding" defined by specific specifications such as those of 5G for satellites (Non-Terrestrial Networks).

Specific objectives:
Identify and model the operation of "Modulation and Coding" defined by specific specifications such as those of 5G for satellites (Non-Terrestrial Networks).

Related activities:
Introducció.
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Introduction.
Processing chain of a communication system
Analog/digital hardware platform
Processor and development environment
Measurement and test methodology
Channel modulation and coding

Full-or-part-time: 12h
Laboratory classes: 5h
Self study : 7h

Bandpass signal

Description:
Know how to convert a complex baseband signal to a real bandpass signal.

Specific objectives:
Adjust the transmission bandwidth and select the center frequency at which to transmit.

Related activities:
Introduction.
Processing chain of a communication system.
Analog/digital hardware platform.
Processor and development environment.
Measurement and test methodology.
Digital Up Converter (DUC) and Digital Down Converter (DDC).

Full-or-part-time: 18h
Laboratory classes: 8h
Self study : 10h

Synchronism in OFDM Systems

Description:
Identify the options for developing the downlink synchronization process in OFDM systems such as LTE and 5G and select the most suitable one.

Specific objectives:
The student must be able to develop the most appropriate synchronization process following robustness and low consumption requirements and taking into account the system specifications.

Related activities:
Introduction.
Processing chain of a communication system.
Analog/digital hardware platform.
Processor and development environment.
Measurement and test methodology
Synchronism in OFDM systems

Full-or-part-time: 28h
Laboratory classes: 12h
Self study : 16h

MIMO and Equalization

Description:
Identify the options to develop the most appropriate equalization process taking into account the MIMO system available in the communications system.

Specific objectives:
The student must be able to propose the most appropriate equalization process following robustness and low consumption requirements and taking into account the system specifications.

Related activities:
Introduction.
Processing chain of a communication system.
Analog/digital hardware platform.
Processor and development environment.
Measurement and test methodology.
Synchronism in OFDM systems.
Equalization in MIMO systems.

Full-or-part-time: 12h
Laboratory classes: 5h
Self study : 7h

Integration and global performance.

Description:
Incorporate a methodology for subsystem integration and partial and global testing of complex systems.

Specific objectives:
Learn to isolate the problem and propose the test, or tests, necessary to verify the working hypotheses, avoiding mixing problems with other parts of the system.

Related activities:
Introduction.
Processing chain of a communication system.
Analog/digital hardware platform.
Processor and development environment.
Measurement and test methodology.

Full-or-part-time: 10h
Laboratory classes: 5h
Self study : 5h

GRADING SYSTEM

The evaluation criteria defined on the subject's infoweb will be applied.

BIBLIOGRAPHY

Basic:
- Reed, Jeffrey Hugh. Software radio : a modern approach to radio engineering. Upper Saddle River, New Jersey: Prentice Hall, cop. 2002. ISBN 0130811580.
- Bateman, Andrew; Yates, Warren. Digital signal processing design. New York: Computer Science Press, cop. 1989. ISBN 0716781883.
- Timothy Pratt, Jeremy E. Allnutt. Satellite Communications.
- CDIO. Satellite Communications Payload and System, Second Edition. 2nd ed. ISBN 9781119384342.
- Roddy, Dennis. Satellite communications [on line]. 4th ed. New York etc: McGraw-Hill, cop. 2006 [Consultation: 26/06/2026]. Available on: https://www-accessengineeringlibrary-com.recursos.biblioteca.upc.edu/content/book/9780071462983?implicit-login=true. ISBN 0071462988.

Complementary:
- Carlson, A. Bruce; Crilly, Paul B.; Rutledge, Janet C. Communication systems : an introduction to signals and noise in electrical communication. 4th ed. New York etc: McGraw-Hill, cop. 2002. ISBN 0070111278.
- Sklar, Bernard. Digital communications : fundamentals and applications [on line]. Second edition, Pearson new international edition. Harlow, Essex, England: Pearson Education Limited, 2014 [Consultation: 26/06/2026]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5185638. ISBN 9781292026060.
- Maral, Gérard; Bousquet, Michel; Sun, Zhili. Satellite communications systems : systems, techniques and technology [on line]. 6th ed. Hoboken, N.J: John Wiley & Sons, 2020 [Consultation: 26/06/2026]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6021106. ISBN 9781119673811.

RESOURCES

Other resources:
Transparencies and documentation posted in Atenea