



# COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

**Syllabus**  
**2025 - 2026**

## GENERAL INFORMATION

Data of the subject	
Subject name	Communications Systems I
Subject code	DEAC-MIT-513
Main program	<a href="#">Official Master's Degree in Telecommunications Engineering</a>
Involved programs	Máster Universitario en Ingeniería de Telecomunicación y Mást. Univ. en Administración de Empresas [First year] Máster Universitario en Ingeniería de Telecomunicación [First year] Máster Universitario en Ingeniería de Telecomunicación y Máster en Ciberseguridad [First year] Máster Universitario en Ingeniería de Telecomunicación + Máster in Smart Grids [First year]
Level	Postgrado Oficial Master
Quarter	Semestral
Credits	6,0 ECTS
Type	Obligatoria
Department	Department of Electronics, Control and Communications
Coordinator	Luis Cucala García
Office hours	Appointment on request

Teacher Information	
<b>Teacher</b>	
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## DESCRIPTION OF THE SUBJECT

Contextualization of the subject
<b>Prerequisites</b>
The prerequisites the student requires to follow the subject in an efficient and fluid way are the following: knowledge on complex



variables, circuit analysis and frequency response, digital signal processing and analog communication systems.

As to computer programming languages and tools, at least a minimum fluency in the use of MATLAB is required.

## Course contents

### Contents

#### Theory

#### Theory

##### **Chapter 1: SIGNAL THEORY**

1.1 Geometric representation of signals

1.2 Modulation and demodulation

1.3 Signal detection

##### **Chapter 2: THE COMMUNICATION CHANNEL**

2.1 AWGN

2.2 Impulsive noise

##### **Chapter 3: PASSBAND DIGITAL TRANSMISSION**

3.1 Communication channel impairments

3.2. Passband digital modulations

##### **Chapter 4: OFDM**

4.1 Multicarrier communications

4.2 OFDM

##### **Chapter 5: CHANNEL CODING**

5.1 Shannon capacity limit

5.2 Block codes

5.3 Convolutional codes

5.4 Decoders (Viterbi)

5.5 High performance codes

##### **Chapter 6: CHANNEL ADAPTATION**

6.1 Channel equalization



6.2 Beamforming (optional)

### Chapter 7: INTRODUCTION TO RADAR TECHNOLOGY

7.1 Elements of RADAR technology

7.2 RADAR basic equation

### Chapter 8: PCB and MICROSTRIP design (Supportive)

8.1 PCB layer structure

8.2 Example of PCB design

## Laboratory

### Laboratory

- 1 Review of signal processing with Matlab
- 2 Baseband digital transmission
- 3 Intersymbol interference
- 4 Digital modulations
- 4 OFDM
- 5 Modelling a commercial transmission system (PRIME)

## EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Mid term exam: 10% Final exam: 45%	<ul style="list-style-type: none"><li>• Concept comprehension</li><li>• Application of concepts to solve practical problems</li><li>• Analysis and evaluation of results obtained in exercise solutions</li><li>• Written communication skills and presentation of results</li></ul>	55
Specification and modelling of commercial transmission system	<ul style="list-style-type: none"><li>• System detailed specification</li><li>• System implementation</li></ul>	25
<ul style="list-style-type: none"><li>• Lab activities</li><li>• Lab exam (optional)</li></ul>	<ul style="list-style-type: none"><li>• Concept comprehension</li><li>• Application of concepts to the solution of practical problems</li></ul>	20



## Grading

Class attendance is compulsory, according to article 93 of ICAI academic regulations. Attendance requirements will be applied in an independent way to theory and laboratory sessions:

- In the case of theory sessions, non compliance of the norm can prevent being examined in ordinary examination call.
- In the case of laboratory sessions, non compliance of the norm can prevent being examined in ordinary and extraordinary calls. In any case, non justified absence to laboratory sessions will be penalized in the evaluation of activities.

Grades in **ordinary call** are obtained as follows:

- Theory and modelling of a commercial transmission system. 80% of the overall subject grade, broken down as final exam grade, 45%, mid term exam grade, 10%, and written report on work of modelling of commercial transmission system, 25%.
- Laboratory. 20% of the overall subject grade. It includes performing complete activities, presentation of specific reports on activity results and, if the professor considers it appropriate, individual or work group evaluations.

To pass the subject in ordinary call, both the final exam and laboratory grades must be greater or equal to 5.

Grading in **extraordinary call** follows the same criteria as in the ordinary call, in the sense that partial grades are retained till they are replaced, where appropriate, by new grades in the extraordinary call.

- Final exam: it has to be repeated if in the ordinary call its mark was below 5
- Laboratory activities: if the overall laboratory mark is below 5 the student will submit, after the ordinary call final exam and at least 48 hours before the date of the final exam in extraordinary call, a new report of the laboratory activities the student considers appropriate, chosen among the ones that are failed (mark below 5).
- Modelling of commercial transmission systems: if the student has to attend the extraordinary call, either as final exam or submission of laboratory activity reports, and the grade of the commercial transmission system modelling is below 5, the student can voluntarily submit a second version of the modelling work report. The submission has to take place after the ordinary call final exam and at least 48 hours before the date of the final exam in extraordinary call.

## WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Reading and study of theoretical contents in the subject documentation	After each session	
Preparation of the tests to be performed during class hours	After each chapter	
Modelling of commercial transmission system	October / November	December
Preparation of final exam	December	
Elaboration of laboratory activity report	Week after ending of individual lab activity	

## BIBLIOGRAPHY AND RESOURCES



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## Basic References

Subject documentation in Moodle

## Additional references

- Proakis, J. G., & Salehi, M. (2008). Digital Communications. McGraw-Hill Higher Education.
- Haykin, S. S. (2013). Digital Communication Systems. Wiley.
- Concepts in Systems and Signals, J. D. Sherrick. Prentice-Hall 2001.
- Discrete-Time Signal Processing (2nd Edition). Oppenheim, Schafer, Buck. Prentice-Hall.
- Digital Signal Processing Handbook. Vijay K. Madisetti, Douglas B. Williams. Chapman & Hall.
- Advanced Signal Processing Handbook. Editor Stergios Stergiopoulos. CRC Press

In compliance with current regulations on the **protection of personal data**, we would like to inform you that you may consult the aspects related to privacy and data [that you have accepted on your registration form](#) by entering this website and clicking on "download"

<https://servicios.upcomillas.es/sedelectronica/inicio.aspx?csv=02E4557CAA66F4A81663AD10CED66792>