Syllabus
2022 - 2023

GENERAL INFORMATION

Data of the subject	
Subject name	Communications Systems I
Subject code	DEAC-MIT-513
Mainprogram	Máster Universitario en Ingeniería de Telecomunicación por la Universidad Pontificia Comillas
Involved programs	Grado en Administración y Dirección de Empresas y Máster Univ. en Ingeniería de Telecomunicación [Fifth year] 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 y Mást. Univ. en Administración de Empresas [First year] Máster Universitario en Ingeniería de Telecomunicación + Máster Big Data.Tecnología y Anal. Avanzada [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	Compulsory
Department	Department of Electronics, Control and Communications
Coordinator	Wsewolod Warzanskyj García
Office hours	Appointment on request

Teacher Information	
Teacher	
Name	Wsewolod Warzanskyj García
Department	Department of Electronics, Control and Communications
EMail	wwarzanskyj@icai.comillas.edu
Teacher	
Name	Miguel Virseda Moreno
Department	Department of Electronics, Control and Communications
EMail	mvirseda@icai.comillas.edu

DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

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%	• Concept comprehension • Application of concepts to solve practical problems • Analysis and evaluation of results obtained in exercise solutions • Written communication skills and presentation of results	55 %
Specification and modelling of commercial transmission system	• System detailed specification • System implementation	25 %
• Lab activities • Lab exam (optional)	• Concept comprehension • Application of concepts to the solution of practical problems	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 examenind in ordinary and extraordinary calls. In any case, non justified absence to laboratory sessions will be penalized in the evalution 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 evalutions.

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 transmision 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	
Preparaton 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

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

	Actividades presenciales								
Semana	h/s	Clase Teoría/Problemas		Laboratorio/Trabajo			Evaluación		
		Tema	Horas		Núm.	Horas		Horas	
1	4	Presentación Tema 1	1 3						
2	4	Tema 1	2	Práctica	1	2			
3	4	Tema 2	4						
4	4	Tema 2	2	Práctica	1	2			
5	4	Tema 3	2	Práctica	2	2			
6	4	Tema 3	4						
7	3	Tema 4	1	Práctica	3	2			
8	4						Ev.	4	
9	4	Tema 4	4						
10	4	Tema 4	2	Práctica	4	2			
11	4	Tema 5	3	Práctica	4	1			
12	4	Tema 6	2	Práctica	5	2			
13	4	Tema 6 Tema 7	2 2						
14	4				PRIME	4			
15	4				PRIME	4			
16	0								
	59	Total horas	34			21		4	
			59						

Resumen

Tema	Horas
Present.	1
1	5
2	6
3	6
4	7
5	4
6	4
7	2
Laboratorio	13
Trabajo	8
Evaluaciones	4
	60

Actividades no presenciales	
Tarea	Horas
Estudio y resolución de problemas	52
Preparación de prácticas	14
Realización informe de prácticas (en equipo)	26
Realización de trabajo de	28
Total	120