SUBJECT TEACHING GUIDE

G836 - Digital Communications

Degree in Telecommunication Technologies Engineering

Academic year 2021-2022

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 3
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Subject Area: Transmission and Treatment of Signals				
Course unit title and code	G836 - Digital Communications				
Number of ECTS credits allocated	6	Term	Semester based (2)		
Web	http://gtas.unican.es/docencia/cd				
Language of instruction	Spanish	English Friendly	No	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	JESUS MARIA IBAÑEZ DIAZ
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Other lecturers	

3.1 LEARNING OUTCOMES
- The student is able to use signal space representation as a tool for analysis and design of digital communication systems.
- Understand and quantify the effects on communication systems performance of the channel and the noise . Also, know the mechanisms used to optimize the performance.
- Know the characteristics of commercial digital communications systems as well as the techniques and algorithms used.
- It is able to implement the base band processing of digital transmitters/receivers.

4. OBJECTIVES

Analyze and design digital communications systems (QAM, FSK, spread spectrum, multicarrier, ...) by using signal space both in AWGN channels and fading channels.

Present the problem of temporal, frequency and phase synchronization as well as related algorithms and techniques.

Introduce the concept of diversity, its variants and how to exploit it properly to increase the performance of digital communications systems.

Present today comercial systems (WiFi, DVB, Bluetooth, ZigBee, UMTS, LTE, ...) as examples of the contents presented throughout the course.

Simulate and implement in the laboratory the transmitters and receivers presented inthe class.

6. COURSE ORGANIZATION

CONTENTS	
1	1 Signal space representatiom. Analysis and simulation of digital communication systems. Low pass equivalent model and discrete equivalent model. 2 AWGN, flat fading and selective channels. Detection in presence of ISI. 3. Introduction to diversity. Time, frequency and spatial diversity. Receiver diversity: SC, MRC, EGC. Transmitter diversity: MRC, Alamouti.
2	4. Multicarrier modulations. OFDM principles and implementation: cyclic prefix, windowing, frequency pilots and guards, coding, interleaving. BER and performance. OFDM systems. 5. Synchronization. Phase, frequency and time synchronization. Synchronization in multicarrier modulations.
3	6. Spread spectrum. Pseudorandom sequences. Direct sequence spread spectrum (DS-SS). Frequency hopping spread spectrum (FH-SS). Synchronization

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final exam	Written exam	Yes	Yes	60,00
Laboratory practices	Laboratory evaluation	No	No	20,00
Follow-up tests	Written exam	No	Yes	20,00
Make-up exam	Written exam	No	No	0,00
TOTAL				100,00

Observations

The final course grade is calculated by the following expression:
Final note = max [(60 FE + 20 LP + 20 FU) / 100 (80 FE + 20 LP) / 100]
where:
FE = Final Examination grade; LP = Laboratory Practice grades; FU = Follow-up tests grades

Observations for part-time students

Part-time students can take the final exam and/or the second-chance exam with a 80% weight. The 20% of the final qualification corresponds to the laboratory evaluation.

8. BIBLIOGRAPHY AND TEACHING MATERIALS
BASIC
Apuntes de la asignatura
B. Sklar, Digital Communications. Fundamentals and Applications, 2ª edición, Prentice-Hall 2001