SUBJECT TEACHING GUIDE

G1493 - Channel Coding

Degree in Telecommunication Technologies Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Degree in Telecommunication Technologies Engineering			Type and Year	Optional. Year 4
Faculty	School of Industrial Engineering and Telecommunications				
Discipline	Speciality Optional Subjects				
Course unit title and code	G1493 - Channel Coding				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web	https://www.tlmat.unican.es/index.php?l=es&p=teaching&s=subjects&ss=g_cc&				
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. INGENIERIA DE COMUNICACIONES
Name of lecturer	LUIS MUÑOZ GUTIERREZ
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Other lecturers	

3.1 LEARNING OUTCOMES

- The student will acquire the knowledge and skills for selecting the most appropriate channel coding schemes fullfiling the requirements imposed by different telecommunication networks and services.

4. OBJECTIVES

The main objective is to study coding and decoding techniques for linear block and convolutional codes most commonly used in communication systems. Furthermore, a detailed analysis of the convolutional codes performance is carried out. This brings the possibility to present trellis coded modulation fundamentals and performance. Last but not least, turbo codes an iterative decoding techniques are tackled.

6. COURSE ORGANIZATION

CONTENTS	
1	Coding fundamentals. User messages. Codeword. Parity-check matrix. Some examples: ISBN.
2	Channel coding fundamentals. Finite fields. Transmission channel. Decision rule. Minimum distance. Concept of erasure. Redundancy and Singleton bound.
3	Decoding with the Slepian table. Choosing the generator-matrix G. Hamming codes. Shortened and extended codes. Correction, detection and residual error probability. Algorithms for incomplete decision schemes.
4	Continuous codes. Convolutional codes. Code memory and constraint lenght. Matrix and polynomial representation. Trellis diagram. Transfer function. Free error distance. Hard vs soft decoding. Viterbi Algorithm and performance evaluation.
5	Trellis coded modulation. Information theory principles of TCM coding gain. TCM design rules. Parallel branches.TCM decoding. Performance analysis.
6	Turbo codes. Parallel concatenation of convolutional codes. Forward and backward convolutional codes. Interleavers. Turbo-code decoding. Soft-Output-Viterbi-Algorithm (SOVA).

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
The students succeeding in the continuous evaluation, by passing the three partial exams, they will not need to make the final one. The final grade will be the average of the continuous evaluation. They might improve the grade carrying out the final exam.	Written exam	No	Yes	100,00
TOTAL				100,00

Observations
The students not attending the lectures or deciding not to participate in the continuous evaluation will obtain the mark corresponding to the final exam.

Observations for part-time students
The students not attending the lectures or deciding not to participate in the continuous evaluation will obtain the mark corresponding to the final exam.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

E. Sanvicente: Understanding Error Control Coding, Springer, 2019
G.C. Clark, J.B. Cain: Error Correction Coding for Digital Communicationss, Plenum Press, 1988.
A. Michelson, A. Levesque: Error-Control Techniques for Digital Communications, John Wiley, 1985.