SUBJECT TEACHING GUIDE

1096 - Theory of Information and Channel Coding

Master's Degree in Telecommunication Engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Master's Degree in Telecommunication Engineering			Type and Year	Compulsory. Year 1
Faculty	School of Industrial Engineering and Telecommunications				
Discipline					
Course unit title and code	1096 - Theory of Information and Channel Coding				
Number of ECTS credits allocated	5	Term		Semester based (2)	
Web	http://gtas.unican.es/docencia/ticc				
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	LUIS IGNACIO SANTAMARIA CABALLERO

3.1 LEARNING OUTCOMES
- The student will learn the main concepts linked to information theory as well as the fundamental limits which apply to communication systems.
- The student will know the limits in terms of source coding and compression techniques.
- The student will cope with the most usual block and convolutional codes.

4. OBJECTIVES

To know the fundamental concepts handled in information theory such entropy, relative entropy and mutual information.
To learn the fundamental limits of source coding and data compression.
To learn the implications linked to channel capacity and the fundamental limits which apply to point -to-point and multipoint communications.
To study the algebraic techniques supporting block channel coding.
To learn the main block code families as well as its coding and decoding techniques.

6. COURSE ORGANIZATION

CONTENTS	
1	Basic concepts in Information Theory. Entropy, relative entropy and mutual information.
2	Source coding. Typical set of sequences and the Asymptotic Equipartition Theorem. Source Coding Shannon Theorem. Fix and variable length codes. Huffman Codes. Lempel-Ziv Coding.
3	Channel capacity. Binary symmetric channel. Binary erasure cannel. Discrete memoryless cannel. Channel Coding and Channel Capacity Theorem. The Gaussian channel. Multiple access and broadcast channels.
4	Basic concepts in channel coding. Interleaving. Code concatenation. Errors and erasures.
5	Albegraic coding and decoding techniques. Finite fields. BCH and RS codes.

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
The subject will be evaluated through a final exam whose mark, FEM, will be weighted with the one linked to the continuous evaluation, CEM, as max (FEM; FEM*0.6+CEM*0.4). A mark FEM>=4.0 is required.	Written exam	Yes	Yes	60,00
The students not attending the lectures or deciding to do not rely on the continous evaluation they will have the mark corresponding to the final exam.	Written exam	No	Yes	40,00
TOTAL				100,00

Observations
The subject will be evaluated through a final exam whose mark, FEM, will be weighted with the one linked to the continuous evaluation, CEM, as the maximum of (FEM; FEM*0.60+CEM*0.40). A mark FEM>=4.0 is required.

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
T. M. Cover, J. A. Thomas, Elements of Information Theory, 2nd Ed., John Wiley, 2006
D. J. MacKay, Information Theory, Inference, and Learning Algorithms, Cambridge University Press, 2003
G. C. Clark, J. B. Cain, Error Correction Coding for Digital Communications, Plenum Press, 1988
A. Michelson, A. Levesque, Error-Control Techniques for Digital Communications, John Wiley, 1985