



## IDENTIFYING DATA

### Multimedia Communications

Subject	Multimedia Communications			
Code	V05M145V01206			
Study programme	Telecommunication Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	2nd
Teaching language	English			
Department				
Coordinator	Comesaña Alfaro, Pedro			
Lecturers	Comesaña Alfaro, Pedro			
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Web				
General description	In the subject "Multimedia Communications" information theory basic concepts are presented. Then, lattices are presented as both source coding and channel coding tools. After commenting some generalities about another source coding strategy, namely Trellis Code Quantization, more advanced coding problems, as distributed source coding and joint source-channel coding, are considered.			

## Competencies

Code	
B1	CG1 Ability to project, calculate and design products, processes and facilities in telecommunication engineering areas.
B4	CG4 Capacity for mathematical modeling, calculation and simulation in technological centers and engineering companies, particularly in research, development and innovation tasks in all areas related to Telecommunication Engineering and associated multidisciplinary fields.
C1	CE1 Ability to apply methods of information theory, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing systems and audiovisual communications.
C4	CE4 Ability to design and plan networks for transporting, broadcasting and distribution of multimedia signals.
C6	CE6 Ability to model, design, implement, manage, operate, and maintain networks, services and contents.
C8	CE8 Ability to understand and know how to apply the operation and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services.

## Learning outcomes

Expected results from this subject	Training and Learning Results
Understanding the fundamental characteristics of a lattice, and the properties we must take into account when facing a source coding problem and a channel coding problem.	B4 C1
Understand that a trellis code defines a lattice and why this construction is useful for source coding (Trellis-Code Quantization)	B4 C1
Understanding of the different distributed source coding schemes.	B1 B4 C1 C4 C8
Implementation of a distributed source coding scheme.	B1 B4 C1 C6 C8
Understanding of the different schemes of joint source and channel coding.	B4 C1 C4 C6 C8

Implementation of a joint and source channel coding scheme.	B1 B4 C1 C4 C6
Understanding of the characteristics of different ways of multimedia signal distribution, paying special attention to streaming schemes.	B1 C4 C6 C8
Assessment of the modularity of new video coding standards (e.g., MPEG-7)	B1 C4 C6 C8

## Contents

### Topic

1) Information theory.	1) Discrete case: Entropy. Conditional entropy. Joint entropy. Mutual information. Kullback-Leibler Divergence. 2) Continuous case: Entropy. Conditional entropy. Joint entropy. Mutual information. Kullback-Leibler Divergence. 3) Jensen's inequality. 4) Shaping gain.
2) Lattices	1) Definition 2) Basic properties
3) Advanced source coding	1) Lloyd-Max quantizer. 2) Trellis Code Quantization.
4) Distributed source coding	1) Lossless coding 2) Lossy coding
5) Joint source-channel coding	1) Shannon's separability principle 2) JSCC practical examples

## Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	13	44	57
Lecturing	15	30	45
Report of practices, practicum and external practices	0	21	21
Essay questions exam	2	0	2

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Laboratory practical	13 hours of PC lab. Programming of computational simulations. The student will simulate, by using a numerical calculus programming language (as Matlab) the multimedia communications systems introduced in this subject.
	Competencies: CG1, CG4, CE1, CE4, CE6, CE8.
Lecturing	15 hours of theoretical lessons, where practical cases will be introduced. Furthermore, autonomous homework exercises will be proposed.
	Competencies: CG1, CG4, CE1, CE4, CE6, CE8.

## Personalized assistance

Tests	Description
Report of practices, practicum and external practices	Individual feedback on the reports will be provided.

## Assessment

	Description	Qualification	Training and Learning Results
Laboratory practical	Numerical simulation programming.	20	B1 B4 C1 C4 C6 C8

Report of practices, practicum and external practices	Report on lab practises and reports on related topics.	20	B1	C1 C4 C6
Essay questions exam	Final exam.	60	B1 B4	C1 C4 C6

### Other comments on the Evaluation

In order to do the weighted average of the different qualifications (corresponding to continuous assessment), the student should submit all the corresponding tasks. Furthermore, a minimum mark of 40% should be achieved in the final exam, and a minimum mark of 40% should be achieved in each lab practice. In case that those thresholds were not achieved, the final mark will be the minimum of the final exam mark and each lab mark (all of them over 10 points)

All the tests, practices and reports will be done individually.

Those student who choose to be evaluated by single assessment will have to do the final exam (based on long answer and development questions), as well as a practical exam; the complexity of the latter will be similar to the work done by the continuous assessment students.

The same rules are applied to the second call.

### Sources of information

#### Basic Bibliography

Cover and Thomas, **Elements of information theory**, 978-0471241959, 2, Wiley, 2006

#### Complementary Bibliography

**Artículos científicos especificados por el profesorado,**

### Recommendations

### Subjects that it is recommended to have taken before

Signal Processing in Communications/V05M145V01102

### Other comments

Even if this subject has not a series of mandatory prerequisites, it is highly recommended that the student has a minimal background on:

- Statistics.
- Signal Processing.
- Channel coding.
- Source coding.
- Internet networks and protocols.

### Contingency plan

#### Description

=== EXCEPTIONAL PLANNING ===

Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

\* Teaching methodologies maintained

All of them

\* Teaching methodologies modified

None of them

\* Non-attendance mechanisms for student attention (tutoring)

## Videoconference

\* Modifications (if applicable) of the contents

N/A

\* Additional bibliography to facilitate self-learning

N/A

\* Other modifications

None

\* Additional Information

Both in the mixed modality and in the non-face-to-face modality, the evaluation scheme contemplated in the corresponding section of this guide will be maintained; the only difference is that the corresponding tests will be done in a non-face-to-face way. Likewise, the planification of the theory and lab lectures will be independent of the modality; in case of mixed or non-face-to-face modalities, IT tools will be used.

In order to enable as much as possible the self-organization of the work by the students, and preventing possible problems of conciliation and/or connectivity, the material used in each session of the subject will be provided to the students well in advance.

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