



# UNIVERSIDAD DE CASTILLA - LA MANCHA

## GUÍA DOCENTE

### 1. General information

**Course:** PROCESSING AND TRANSMISSION

**Type:** CORE COURSE

**Degree:** 385 - DEGREE IN TELECOMMUNICATIONS TECHNOLOGY ENGINEERING

**Center:** 308 - SCHOOL POLYTECHNIC OF CUENCA

**Year:** 3

**Main language:** Spanish

**Use of additional languages:**

**Web site:**

**Code:** 59658

**ECTS credits:** 6

**Academic year:** 2023-24

**Group(s):** 30

**Duration:** First semester

**Second language:**

**English Friendly:** Y

**Bilingual:** N

**Lecturer:** MARCOS DAVID FERNANDEZ BERLANGA - Group(s): 30

Building/Office	Department	Phone number	Email	Office hours
E. Politécnica Cuenca (2.15)	INGENIERÍA ELÉCTRICA, ELECTRÓNICA, AUTOMÁTICA Y COMUNICACIONES	926053935	marcos.fernandez@uclm.es	The updated hours of attention at the office will be displayed in the Virtual Secretary.

### 2. Pre-Requisites

The following subjects are recommended to have been attended with profit: Maths, Signals, Foundations on Communications, Programming and Telematics.

### 3. Justification in the curriculum, relation to other subjects and to the profession

This course introduces the digital treatment of information to be transmitted from the point of view of information theory; therefore, first the information will be efficiently represented and then it will be protected for both, possible transmission errors and possible tapping and non-authorized modifications.

This course is of great utility in the field of signal processing, efficient transmission and cybersecurity.

It is recommended to take profit of this course before attending the elective of 'Security of Communications'.

### 4. Degree competences achieved in this course

#### Course competences

Code	Description
E31	The ability to analyse, encode, process and transmit multimedia information using analogue and digital signal processing techniques.
G01	Knowledge of Information and Communication Technologies (ICT).
G02	Correct, oral and written, communication skills.
G06	Knowledge of basic subjects and technologies, enabling students to learn new methods and technologies, as well as providing great versatility to adapt to new situations
G07	The ability to tackle problems with initiative, making decisions, creativity, and to communicate and transmit knowledge, skills and abilities, including the ethical and professional responsibility of the activity of a Technical Telecommunications Engineer
G12	The ability to work in a multidisciplinary group and in a multilingual environment and to communicate, both in writing and orally, knowledge, procedures, results and ideas related to telecommunications and electronics
G13	The ability to look for and understand information, whether technical or commercial in different sources, to relate and structure it to integrate ideas and knowledge. Analysis, synthesis and implementation of ideas and knowledge.

### 5. Objectives or Learning Outcomes

#### Course learning outcomes

##### Description

Analysis, synthesis and compression of technical documentation and mastery of specific vocabulary.

Knowledge of the different transmission channel models.

Knowledge of the basic mechanisms of channel equalization.

Knowledge of the processes to be carried out in the receiving system.

Identification and understanding of a digital transmission system extended scheme and its basic quality parameters.

Correct use of oral and written expression to convey ideas, technologies, results, etc.

Distinction between secret key and public key encryption.

Application of signal processing techniques to encode and protect multimedia information in a transmission system.

Recognition of the need of communication encryption.

Distinction and construction of both block and convolutional corrective error codes.

Distinction and construction of compression codes without and with losses.

Identification of different multimedia data compression and codification algorithms.

Carrying out calculations of event uncertainties, entropy and mutual information.

Use of ICT to achieve the specific objectives set in the subject.

## 6. Units / Contents

### Unit 1: Information theory

**Unit 1.1** Elements of a digital communication system

**Unit 1.2** Information and entropy

**Unit 1.3** Channel modelling

### Unit 2: Source coding

**Unit 2.1** Foundations

**Unit 2.2** Lossless encoding

**Unit 2.3** Lossy encoding

**Unit 2.4** Applications in communications, audio and video

### Unit 3: Cryptography

**Unit 3.1** Foundations

**Unit 3.2** Secret key systems

**Unit 3.3** Public key systems

**Unit 3.4** Security services in communications and multimedia contents

### Unit 4: Channel coding

**Unit 4.1** Foundations

**Unit 4.2** Block coding

**Unit 4.3** Convolutional coding

**Unit 4.4** Uses and applications in communications, audio and video

### Unit 5: Introduction to equalization

**Unit 5.1** Types of equalizers

**Unit 5.2** Calculation of a basic equalizer

### Unit 6: Laboratory

**Unit 6.1** Entropy and compression

**Unit 6.2** Cryptographic tools

**Unit 6.3** Channel coding

## ADDITIONAL COMMENTS, REMARKS

Software: Matlab, CrypTool, programming and simulation languages and environments.

Hardware: computer (no specific requirements).

## 7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E31 G01 G02 G06	0.75	18.75	N	-	Theoretical lectures.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E31 G01 G07 G12	0.68	17	N	-	The teacher will show some demonstrations and problem solving techniques to illustrate some parts of the course.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E31 G01 G02 G06 G12 G13	0.8	20	Y	N	The students will carry on practical work according to the provided instructions. Their work will be monitored in-situ and may modulate the marks obtained in the practical part. This activity cannot be recovered.
Practicum and practical activities report writing or preparation [OFF-SITE]	Practical or hands-on activities	E31 G01 G02 G06 G12 G13	0.6	15	Y	Y	The students should hand out a report of each practical activity according to the conditions provided and even including additional files of results and configurations. In some cases, an oral defense of the work could be demanded. These activities can be recovered by repeating the specified parts, individually and in an independent manner, but with tutorial support and with a compulsory oral defense. Plagiarism or copying will be punished with a mark of 0 point to all the people involved.
Writing of reports or projects [OFF-SITE]	Problem solving and exercises	E31 G01 G06 G07 G12	0.2	5	N	-	Self-work to prepare the part of problem solving.
Individual tutoring sessions [ON-SITE]		E31 G01 G02 G06 G12 G13	0.07	1.75	N	-	Personal attention to the students.
Final test [ON-SITE]	Assessment tests	E31 G01 G02 G06 G12 G13	0.1	2.5	Y	Y	Final exam including theory and problems. This could be recovered in the fixed session of the extraordinary call.
Study and Exam Preparation [OFF-SITE]	Self-study	E31 G01 G02 G06 G12 G13	2.6	65	N	-	Self-study.

Writing of reports or projects [OFF-SITE]	Combination of methods	E31 G01 G02 G06 G07 G12 G13	0.2	5	Y	N	Autonomous and individual/in groups tasks of case resolution and information research about applications related with the subject under the premises that will be given and using active methodologies (flipped-classroom, gaming, etc). Oral presentation might be demanded. These tasks cannot be retaken. Plagiarism will be punished with a 0 marks to all the people involved.
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Laboratory sessions	40.00%	40.00%	The job carried out along the lab activities will be considered (direct observation), as well as those reports demanded to be handed-on and the oral presentation and defense of the required tasks.
Final test	50.00%	50.00%	A final written test on theory and problem solving will be considered.
Other methods of assessment	10.00%	10.00%	
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

Weights stated in the 'Grading System' section will be applied, whenever that in both, 'final test' and 'laboratory sessions', the scores obtained were, at least, equal or higher than 4 points or, on the contrary, the course will be assessed as failed.

##### Non-continuous evaluation:

The teacher must be informed at the beginning of the semester in case a student cannot regularly attend face-to-face training activities, so that a personalized carrying-out and handing-out scheme could be agreed.

A student cannot follow non-continuous evaluation if he has attended activities that imply at least 50% of the global marks or if the period of regular classes has already finished.

Weights stated in the 'Grading System' section will be applied, whenever that in both, 'final test' and 'laboratory sessions', the scores obtained were, at least, equal or higher than 4 points or, on the contrary, the course will be assessed as failed.

#### Specifications for the resit/retake exam:

'Final test' could be retaken through an exam in the official stated date. The way to reassess the rest of the retaking activities will be specified in 'Campus Virtual' after closing the regular assessment period. The same weights as in the ordinary period will be applied.

#### Specifications for the second resit / retake exam:

It will be assessed through a theory-practice exam in the official stated date. Weights will be 40% laboratory and 60% exam.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	5
Individual tutoring sessions [PRESENCIAL][]	1.75
Final test [PRESENCIAL][Assessment tests]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	65
Writing of reports or projects [AUTÓNOMA][Combination of methods]	5
<b>General comments about the planning:</b> Units will be taught consecutively along the real calendar of the term in which the course is placed. The planning of the course could slightly change to be adapted to the appropriate progress of the class. During the beginning of the term, the weekly planning will be published in virtual campus.	
<b>Unit 1 (de 6): Information theory</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
<b>Unit 2 (de 6): Source coding</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
<b>Unit 3 (de 6): Cryptography</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	6

Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5.5
<b>Unit 4 (de 6): Channel coding</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	7
<b>Unit 5 (de 6): Introduction to equalization</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
<b>Unit 6 (de 6): Laboratory</b>	
<b>Activities</b>	<b>Hours</b>
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	15
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	17
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Practicum and practical activities report writing or preparation [AUTÓNOMA][Practical or hands-on activities]	15
Writing of reports or projects [AUTÓNOMA][Problem solving and exercises]	5
Individual tutoring sessions [PRESENCIAL][]	1.75
Final test [PRESENCIAL][Assessment tests]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	65
Class Attendance (theory) [PRESENCIAL][Lectures]	18.75
Writing of reports or projects [AUTÓNOMA][Combination of methods]	5
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Rifà, Josep; Huguet, Llorenç	Comunicación digital. Teoría matemática de la información.	Masson		84-311-0576-3	1991	
Proakis, John G.	Digital communications	McGraw-Hill International Book Company		0-07-Y66490-0	1983	
Sklar, Bernard.	Digital communications : fundamentals and applications /	Pearson,		978-1-292-02606-0	2014	
Togneri, Roberto	Fundamentals of information theory and coding design	Chapman & Hall/CRC		978-1-58488-310-4	2003	
	<a href="https://campusvirtual.uclm.es">https://campusvirtual.uclm.es</a>					Espacio virtual de la asignatura