UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: PROCESSING AND TRANSMISSION
Code: 59658
Type: CORE COURSE
ECTS credits: 6
Degree: 385 - DEGREE IN TELECOMMUNICATI TECHNOLOGY ENGINEERING
Academic year: 2020-21
Center: 308 - SCHOOL POLYTECHNIC OF CUENCA
Group(s): 30
Year: 3
Duration: First semester
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
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	It will be stated at the beginning of the semester.

2. Pre-Requisites

The following subjects are recommended to have been attented 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, wether 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
Carrying out calculations of event uncertainties, entropy and mutual information.
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.
Use of ICT to achieve the specific objectives set in the subject.
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.
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.
Distinction between secret key and public key encryption.
Application of signal processing techniques to encode and protect multimedia information in a transmission system.
Analysis, synthesis and compression of technical documentation and mastery of specific vocabulary.

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	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E31 G01 G07 G12	0.68	17	N	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E31 G01 G02 G06 G12 G13	0.8	20	Y	N	
Practicum and practical activities report writing or preparation [OFF-SITE]	Practical or hands-on activities	E31 G01 G02 G06 G12 G13	0.8	20	Y	N	
Writing of reports or projects [OFF-SITE]	Problem solving and exercises	E31 G01 G06 G07 G12	0.2	5	N	-	
Individual tutoring sessions [ON-SITE]		E31 G01 G02 G06 G12 G13	0.07	1.75	N	-	
Final test [ON-SITE]	Assessment tests	E31 G01 G02 G06 G12 G13	0.1	2.5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	E31 G01 G02 G06 G12 G13	2.6	65	N	-	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

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
Final test	60.00%	60.00%	A final written test on theory and problem solving will be considered.
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.
Total:	**100.00%**	**100.00%**	

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 had a proper excuse not to regularly attend face-to-face training activities, so that a personalized carrying-out and handing-out scheme could be agreed.
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 offcial 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

General comments about the planning: 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.

Unit 1 (de 6): Information theory

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1

Unit 2 (de 6): Source coding

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2

Unit 3 (de 6): Cryptography

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5.5

Unit 4 (de 6): Channel coding

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	7

Unit 5 (de 6): Introduction to equalization

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5

Unit 6 (de 6): Laboratory

Activities	**Hours**
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]	20

Global activity

Activities	**hours**
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]	20
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
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Proakis, John G.	Digital communications	McGraw-Hill International Book Company		0-07-Y66490-0	1983	
Rifà, Josep; Huguet, Llorenç	Comunicación digital. Teoría matemática de la información.	Masson		84-311-0576-3	1991	

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	
	https://campusvirtual.uclm.es				Espacio virtual de la asignatura