IDENTIFYING DATA
Data Communication

Subject	Data Communication
Code	V05G300V01301
Study programme	Degree in Telecommunications Technologies Engineering

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st

Teaching language	Spanish
Department	
Coordinator	López García, Cándido Antonio
Lecturers	Díaz Redondo, Rebeca Pilar Herrería Alonso, Sergio López García, Cándido Antonio Sousa Vieira, Estrella Suárez González, Andrés
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General description	In this subject the efficiency and reliability of data transmission using discrete memoryless channels will be analyzed, and the next issues will be introduced: * lossless data compression methods, * linear error control codes, * data link layer protocols, and * multiple access channels protocols and technologies.

Competencies

Code	
B3	CG3: The knowledge of basic subjects and technologies that enables the student to learn new methods and technologies, as well as to give him great versatility to confront and adapt to new situations
B4	CG4: The ability to solve problems with initiative, to make creative decisions and to communicate and transmit knowledge and skills, understanding the ethical and professional responsibility of the Technical Telecommunication Engineer activity.
C11	CE11/T6: The ability to conceive, deploy, organize and manage networks, systems, services and Telecommunication infrastructures in residential (home, city, digital communities), business and institutional environments, being responsible for launching of projects and continuous improvement like knowing their social and economical impact.
C17	CE17/T12: The knowledge and usage of concepts of communication network architecture, protocols and interfaces.
C18	CE18/T13: The ability to differentiate the concepts of access and transport networks, packet and circuit switched networks, mobile and fixed networks, as well as distributed newtwork application and systems, voice, data, video, audio, interactive and multimedia services.
C20	CE20/T15: The knowledge of national, European and international telecommunication regulations and laws.
D2	CT2 Understanding Engineering within a framework of sustainable development.
D3	CT3 Awareness of the need for long-life training and continuous quality improvement, showing a flexible, open and ethical attitude toward different opinions and situations, particularly on non-discrimination based on sex, race or religion, as well as respect for fundamental rights, accessibility, etc.

Learning outcomes

Expected results from this subject	Training and Learning Results		
Understanding the basics of the processes of digital transmission of information, the mathematical models of the channels and the concept of capacity.	B3	C17	D3
Knowledge and ability to analyze the ways of achieving reliable data transmission.	B3 B4	C17 C20	D2 D3

Understanding the methods of sharing multiple access channels, their limits and the factors that affect their performance.	B3	C11 C18	D3
Master the main technical standards, interfaces and protocols in the field of data transmission and local networks.	B3	C20	D3
Practice with interfaces and protocols in the laboratory, as well as in the development of basic transmission solutions.	B3	C20	D3

Contents

Topic

Unit 1. Fundamentals of discrete Information Theory	1.1. A basic model of data communication systems 1.1.1. Discrete sources: discrete memoryless sources 1.1.2. Discrete channels: discrete memoryless channels 1.1.3. Source coding and channel coding 1.2. Information measures 1.2.1. Entropy. Joint entropy 1.2.2. Conditional entropy 1.2.3. Mutual information 1.3. Shannon's source coding theorem 1.3.1. Uniquely decodable codes: instantaneous codes 1.3.2. Kraft's theorem. McMillan's theorem 1.3.3. Optimal codes. Code redundancy 1.3.4. Shannon's source coding theorem 1.3.5. Compact codes. Huffman's algorithm 1.4. Shannon's noisy channels coding theorem 1.4.1. Channel capacity 1.4.2. Symmetric channels 1.4.3. Shannon's noisy channels coding theorem
Unit 2. Data transmission error control	2.1. Linear codes 2.1.1. Definition and matrix description 2.1.2. Syndrome decoding 2.1.3. Error detection and correction properties 2.1.4. Hamming codes 2.1.5. Cyclic codes 2.2. ARQ protocols 2.2.1. Stop and wait 2.2.2. Go-back n 2.2.3. Selective repeat
Unit 3. Multiple access channels and local area networks	3.1. Multiple access channels 3.1.1. The multiple access channel: definition and types 3.1.2. MAC protocols: Aloha, CSMA and variants 3.1.3. Performance of MAC protocols 3.2. Local area networks 3.2.1. Wi-Fi networks 3.2.2. Ethernet networks 3.2.3. Switching ethernet 3.2.4. Virtual local networks

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	28	0	28
Previous studies / activities	0	47	47
Troubleshooting and / or exercises	24	0	24
Autonomous troubleshooting and / or exercises	0	47	47
Long answer tests and development	3	0	3
Short answer tests	1	0	1

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

Methodologies

Description

Master Session	Systematic exposition of the theoretical contents of the subject, emphasizing the aims, fundamental concepts and relationships between the different units. Through this methodology the competencies CE11, CE17, CE18, CE20, CG3 and CT2 are developed.
Previous studies / activities	Students will study the theoretical contents of the subject using the textbook and/or further material. Through this methodology the competencies CE11, CE17, CE18, CE20, CG3 and CT2 are developed.
Troubleshooting and / or exercises	Selected problems and/or exercises will be solved in detail, emphasizing the theoretical concepts involved and the methodology of resolution. Through this methodology the competencies CE11, CE17, CE18, CE20, CG4 and CT3 are developed.
Autonomous troubleshooting and / or exercises	Students will try to autonomously solve a problems and/or exercises from a proposed collection. Through this methodology the competencies CE11, CE17, CE18, CE20, CG4 and CT3 are developed.

Personalized attention

Methodologies	Description
Previous studies / activities	Students will receive personalized attention (in the professor's office, during the office hours) to resolve doubts that can arise in the autonomous study of the subject.
Autonomous troubleshooting and / or exercises	Students will receive personalized attention (in the professor's office, during the office hours) to resolve doubts that can arise in the autonomous resolution of exercices.

Assessment

	Description	Qualification	Training and Learning Results		
Long answer tests and development	Two partial examinations. In each one of them we will evaluate all the competencies corresponding to the contents we have seen in class to date of the examination.	70	B3 B4	C11 C17 C18 C20	D2 D3
Short answer tests	They will be realised with periodicity roughly twice-weekly during the sessions of type B classes.	30	B3	C17 C18	D3

Other comments on the Evaluation

A continuous evaluation of the learning will be practiced. This evaluation consist of two types of tests: short tests, every two weeks, to evaluate the steady student learning, that will take place during the group B sessions; and two partial examinations, the first one in the midterm and the second one at the end of the class period. These tests will not be repeatable and will only be accountable in the current course.

The assessment of the continuous work will be obtained as the weighted average of all the mentioned tests: 30% due to all the short tests (equally weighted) and 35% of each one of the partial examinations, whenever the average score of partial examinations was not less than 3,5. In other case, the grade of the continuous evaluation will be the average score obtained in the partial examinations.

All the students that have not reached at least a score of 5 in the continuous evaluation (included the students not evaluated) can do a final examination, that will include ALL the contents of the subject and that will take place in the exam period scheduled by the Centre. In this case, the final grade of the subject will be the exam score.

All the students that are bound to continuous evaluation or take the final examination will be graded. The students that attend to the second partial exam will be considered bound to continous evaluation.

Those who do not surpass the subject at the earliest opportunity have a second one consistent in the realisation of a new final examination.

In case of plagiarism in any one of the tests (short tests, partial examinations or final examination), the final grade will be FAIL (0) and the fact will be reported to the direction of the Centre for the timely effects.

Sources of information

Basic Bibliography

C. López García, M. Fernández Veiga, **Teoría de la Información y Codificación, 2/e**, 2013,

Complementary Bibliography

C. López García, M. Fernández Veiga, **Cuestiones de Teoría de la Información y Codificación**, 2003,

J. F. Kurose, K. W. Ross, **Computer Networking, 6/e**, 2012,

Recommendations
Subjects that continue the syllabus
Computer Networks/V05G300V01403

Subjects that it is recommended to have taken before
Mathematics: Linear algebra/V05G300V01104
Mathematics: Calculus 1/V05G300V01105
Mathematics: Probability and Statistics/V05G300V01204

C. López García, M. Fernández Veiga, **Cuestiones de Teoría de la Información y Codificación**, 2003,

J. F. Kurose, K. W. Ross, **Computer Networking, 6/e**, 2012,

Recommendations
Subjects that continue the syllabus
Computer Networks/V05G300V01403