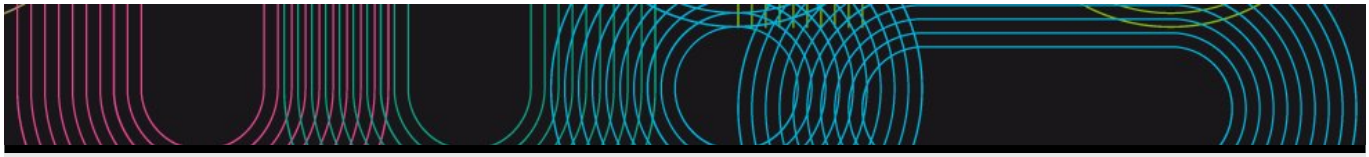

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Data Communication** | | | | |
| Subject | Data Communication | | | |
| Code | V05G306V01204 | | | |
| Study programme | Bachelor Degree in Telecommunication Technologies Engineering (BTTE) | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Mandatory | 2nd | 1st |
| Teaching language | English | | | |
| Department | | | | |
| Coordinator | Díaz Redondo, Rebeca Pilar | | | |
| Lecturers | Díaz Redondo, Rebeca Pilar<br>Fernández Veiga, Manuel | | | |
| E-mail | rebeca@det.uvigo.es | | | |
| Web | http://moovi.uvigo.gal | | | |
| 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:<br>* lossless data compression methods,<br>* linear error control codes,<br>* data link layer protocols, and<br>* multiple access channels protocols and technologies. | | | |

| Training and Learning Results | |
|---|---|
| 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. |

| Expected results from this subject | Training and Learning Results | | |
|---|---|---|---|
| Understanding the basics of digital transmission of information processes, the mathematical models of channels and the concept of capacity. | B3 | C17 | |
| Knowledge and ability to analyze the ways of achieving reliable data transmission. | B3<br>B4 | C17<br>C20 | D2<br>D3 |
| Understanding the methods of sharing multiple access channels, their limits and the factors that affect their performance. | B3 | C11<br>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<br>1.1.1. Discrete sources: discrete memoryless sources<br>1.1.2. Discrete channels: discrete memoryless channels<br>1.1.3. Source coding and channel coding<br><br>1.2. Information measures<br>1.2.1. Entropy. Joint entropy<br>1.2.2. Conditional entropy<br>1.2.3. Mutual information<br><br>1.3. Shannon's source coding theorem<br>1.3.1. Uniquely decodable codes: instantaneous codes<br>1.3.2. Kraft's theorem. McMillan's theorem<br>1.3.3. Optimal codes. Code redundancy<br>1.3.4. Shannon's source coding theorem<br>1.3.5. Compact codes. Huffman's algorithm<br><br>1.4. Shannon's noisy channels coding theorem<br>1.4.1. Channel capacity<br>1.4.2. Symmetric channels<br>1.4.3. Shannon's noisy channels coding theorem |
| Unit 2. Data transmission error control | 2.1. Linear codes<br>2.1.1. Definition and matrix description<br>2.1.2. Syndrome decoding<br>2.1.3. Error detection and correction properties<br>2.1.4. Hamming codes<br>2.1.5. Cyclic codes<br><br>2.2. ARQ protocols<br>2.2.1. Stop and wait<br>2.2.2. Go-back n<br>2.2.3. Selective repeat |
| Unit 3. Multiple access channels and local area networks | 3.1. Multiple access channels<br>3.1.1. The multiple access channel: definition and types<br>3.1.2. MAC protocols: Aloha, CSMA and variants<br>3.1.3. Performance of MAC protocols<br><br>3.2. Local area networks<br>3.2.1. Wi-Fi networks<br>3.2.2. Ethernet networks<br>3.2.3. Switching ethernet<br>3.2.4. Virtual local networks |
| Practical sessions (B) | Sessions to solve problems related to the content of the course. |

| **Planning** | | | |
|---|---|---|---|
| | Class hours | Hours outside the classroom | Total hours |
| Lecturing | 36 | 0 | 36 |
| Previous studies | 0 | 44 | 44 |
| Problem solving | 22 | 0 | 22 |
| Autonomous problem solving | 0 | 43 | 43 |
| Essay questions exam | 4 | 0 | 4 |
| Problem and/or exercise solving | 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 |

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

**Personalized assistance**

| Methodologies | Description |
|---|---|
| Previous studies | Students will receive personalized attention (during the office hours) to resolve doubts that can arise in the autonomous study of the subject. Office hours: Rebeca P. Díaz Redondo: https://moovi.uvigo.gal/user/profile.php?id=11470 Sergio Herrería Alonso: https://moovi.uvigo.gal/user/profile.php?id=11341 Manuel Fernández Veiga: https://moovi.uvigo.gal/user/profile.php?id=11641 Cándido López García: https://moovi.uvigo.gal/user/profile.php?id=11339 |
| Autonomous problem solving | Students will receive personalized attention (during the office hours) to resolve doubts that can arise in the autonomous resolution of exercices. Office hours: Rebeca P. Díaz Redondo: https://moovi.uvigo.gal/user/profile.php?id=11470 Sergio Herrería Alonso: https://moovi.uvigo.gal/user/profile.php?id=11341 Manuel Fernández Veiga: https://moovi.uvigo.gal/user/profile.php?id=11641 Cándido López García: https://moovi.uvigo.gal/user/profile.php?id=11339 |

**Assessment**

| | Description | Qualification | Training and Learning Results | | |
|---|---|---|---|---|---|
| Essay questions exam | 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. | 80 | B3<br>B4 | C11<br>C17<br>C18<br>C20 | D2<br>D3 |
| Problem and/or exercise solving | Two short exams, whose dates will be published at the beginning of the term. | 20 | B3 | C17<br>C18 | D3 |

**Other comments on the Evaluation**

A continuous assessment of the learning will be practised. Continuous assessment will consist of two types of tests: two short tests and two partial exams, the first one in the midterm and the second one at the end of the class period. All these tests will not be repeatable and will only be accountable for the ordinary call in the current course. The schedule of the midterm/intermediate exams will be approved in the Comisión Académica de Grado (CAG) and will be available at the beginning of each academic semester.

The continuous assessment grade will be obtained as the weighted average of the grades of all the mentioned tests: 20% due to all the short tests (equally weighted) and 40% of each one of the partial exams, whenever the average grade of partial exams was not less than 3.5. In other case, the grade of the continuous assessment will be the average grade obtained in the partial exams. If, in this case, the grade is 5 or more than 5, the final grade will be  No pass (4.5).

All the students can do a final exam (global assessment), 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 grade.

All the students following continuous assessment or taking the final exam will be graded. The students that attend to the second partial exam will be considered following continuous assessment. Once a student has decided to follow the continuous assessment, his/her grade will never be no show ("no presentado").

Those students who do not pass the subject at the ordinary exam have a second one consistent in the realisation of a new final exam (extraordinary exam).

In the endo-of-program exam the assessment will just consist in the realisation of a written exam including ALL the contents of the subject.

Plagiarism is regarded as serious dishonest behaviour. If any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the corresponding academic authorities for prosecution.

## 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, 7/e**, 2017,

## Recommendations

### Subjects that continue the syllabus

Computer Networks/V05G301V01210

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

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101
Mathematics: Probability and Statistics/V05G301V01107