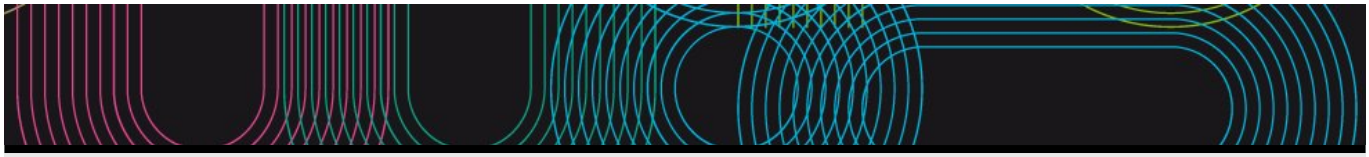

IDENTIFYING DATA				
Mathematics: Probability and Statistics				
Subject	Mathematics: Probability and Statistics			
Code	V05G306V01107			
Study programme	Bachelor Degree in Telecommunication Technologies Engineering (BTTE)			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	English			
Department				
Coordinator	Alonso Alonso, Ignacio			
Lecturers	Alonso Alonso, Ignacio			
E-mail	ignacio.alonso@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	The aim of this subject is to study some basic concepts of statistics, probability and random processes. These concepts are necessary in order to easily follow other subsequent subjects.			

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.
C1	CE1/FB1: The ability to solve mathematical problems in Engineering. The aptitude to apply knowledge about linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations; numerical methods, numerical algorithms, statistics and optimization
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		
Learn how to distinguish between deterministic or random models	B4	C1	D2
Identify a probabilistic model that fits with the needs of a specific problem	B3 B4	C1	D2 D3
Propose solutions to simplify statistical models by using deterministic parameters	B3 B4	C1	D2 D3

Contents	
Topic	
Probability theory	Concept of probability. Axiomatic definition. Conditional probability, total probability and Bayes theorems. Independence.

One-dimensional random variables	Concept of random variable (RV). Classification. Cumulative distribution function (CDF) and properties. Discrete random variables: probability mass function. Continuous random varriables: density function. Functions of an RV. CDF and discrete RV. Transformation of continuous RVs: fundamental theorem. Mean and variance.
Random vectors	CFD and continuous RV. Marginals. Point and line masses. Conditional density. Continuous versions of Bayes and total probability theorems. Functions of two-dimensional RVs: fundamental theorem. Changes of dimension. Correlation and regression.
Estimation and limit theorems	Sample and population. Estimators. Estimation of mean and variance. Sequences of RVs. Laws of large numbers. Central limit theorem.
Stochastic processes	Description of a stochastic process. Statistics of a stochastic process. Stationarity. Examples.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	14	42
Problem solving	17	34	51
Practices through ICT	14	7	21
Problem and/or exercise solving	1	6	7
Objective questions exam	1	6	7
Essay questions exam	2	14	16
Essay	0	6	6

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

Methodologies

	Description
Lecturing	The course is divided in five main topics. Each topic will have a theoretical part that will be exposed by the teacher. Students will be required to perform a previous reading of the contents. Through this methodology the competencies CG3, CE1 and CT3 are developed.
Problem solving	Each topic will be complemented with problem resolution. The problems could be developed and solved in big or small group classes. The students will be required to work previously on these problems. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.
Practices through ICT	Each topic will be completed with one or several sessions of computer practices. For this, a software developed by the teachers (based on Python) and specific questionnaires for each topic will be used. Students will be required to perform a previous reading of the contents. Through this methodology the competencies CG3, CG4, CE1, CT2 and CT3 are developed.

Personalized assistance

Methodologies	Description
Lecturing	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.
Problem solving	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.

Practices through ICT	Students will have the opportunity to attend one-on-one tutorials, in person or online. Each teacher, at the beginning of the term, will establish the schedule and characteristics of the offered tutorials. The contact details of the teaching staff are specified on the subject's page, on MooVi (https://moovi.uvigo.gal), within the "Teaching staff and tutorials" section.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Students must solve a problem individually	20	B3 B4	C1
Objective questions exam	Students must answer a multiple choice test individually	25	B3 B4	C1
Essay questions exam	Individual final exam	40	B3 B4	C1
Essay	Individual submission of a problem solved independently	15	B3 B4	C1

Other comments on the Evaluation

Following the guidelines of the degree, two assessment systems will be offered to the students: Continuous assessment or Global assessment.

Each student can decide himself to follow or not Continuous assessment. It is assumed that a student follows this assessment system if he sits task 2 (around the seventh week of the term) or any later task. Sitting Task 1 (both, part 1 and part 2) does not bind the student to Continuous assessment. Even so, on the day of the final exam, the student will be able to choose Global assessment.

Students who choose Continuous assessment:

Several midterm tasks are assessed with a grade between 0 and 10. In this assessment method, the final grade will be calculated as a weighted average, with the weights specified below, of the grades of the different midterm tasks and the final exam. The schedule of the midterm tasks will be approved in the Comisión Académica de Grado (CAG) and it will be available at the beginning of each academic semester.

A brief description of the tasks and their weight in the final grade is listed below:

- Task 1: Weight 20%. Two parts, both with the same weight:
  - Part 1: Individual resolution of a problem
  - Part 2: Correction of a solution of the same problem solved by someone else
- Task 2: Individual resolution of a multiple choice test. Weight 25%
- Task 3: Submission of a problem solved individually. Once the problem has been assigned, the deadline for submission is 48 hours later. Weight 15%
- Last Task: Final exam. A reduced version of the exam to be carried out by the students who choose Global assessment. Weight 40%

Before the completion or delivery of each task, the date and procedure for its review will be indicated. Students will have the option to know the grade of each task and review its correction within a reasonable period of time (around one week).

These tasks are not recoverable, that is, if a student cannot sit them, teachers will not be committed to repeat them, unless in the case of documented justified reasons.

The obtained grades will be valid only for the current academic course.

If a student is binded to Continuous assessment and does not pass the course he/she will receive a grade of fail, regardless of he/she sits the final exam or not.

Students who choose Global assessment or End-of-program exam:

In these cases students will just carry out a single final exam. This exam will be graded between 0 and 10, and this value will be the final grade of the student.

Extraordinary exam:

The extraordinary exam is only available for students who have not passed the subject previously and they have to choose

between Continuous and Global assessment, regardless of the system they chose at the Ordinary exam. The choice has to be made when handing in the exam to the teacher. On the other hand, grades will be obtained using the corresponding assessment system as it has been described above.

The subject is considered passed if the final grade obtained is greater than or equal to 5.

Plagiarism is regarded as serious dishonest behavior. 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

JR Fernández, I. Alonso y A. Mojón, **Apuntes de Probabilidad y Estadística**, 13 ed, 2024

JR Fernández, I. Alonso and A. Mojón, **Notes on Probability and Statistics**, 3 ed, 2024

A Mojón, I. Alonso y JR Fernández, **Vídeos de la asignatura de Probabilidad y Estadística**, 1 ed, UVigoTV, 2014

X. Rong Li, **Probability, Random Signals and Statistics**, 1 ed, CRC Press, 1999

R. Cao y otros, **Introducción a la estadística y sus aplicaciones**, 1 ed, Pirámide, 2001

Complementary Bibliography

H. Stark y J.W. Woods, **Probability, Random Processes, and estimation theory for engineers**, 2 ed, Prentice Hall, 1994

D. Peña, **Estadística, modelos y métodos. Tomo 1: Fundamentos**, 2 ed, Alianza Universidad Textos, 1991

P. Peebles, **Principios de probabilidad, variables aleatorias y señales aleatorias**, 4 ed, McGraw-Hill, 2006

A. Papoulis, **Probability, random variables and stochastic processes**, 4 ed, McGraw-Hill, 2002

A. Blasco y S. Pérez-Díaz, **Modelos aleatorios en ingeniería**, 1 ed, Paraninfo, 2015

Recommendations

Subjects that continue the syllabus

Data Communication/V05G301V01204
Computer Networks/V05G301V01210
Signal Transmission and Reception Techniques/V05G301V01208
Basics of bioengineering/V05G301V01415

Subjects that are recommended to be taken simultaneously

Mathematics: Calculus 2/V05G301V01106

Subjects that it is recommended to have taken before

Mathematics: Linear algebra/V05G301V01102
Mathematics: Calculus 1/V05G301V01101