Universidade Vigo

IDENTIFYING DATA
Mathematics: Probability and Statistics

Subject	Mathematics: Probability and Statistics
Code	V05G306V01107
Study programme	Degree in Telecommunications Technologies Engineering - Teaching in English

Descriptors	ECTS Credits		Choose	Year	Quadmester
	6		Basic education	1st	2nd

Teaching language	English
Department	
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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.

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.
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.

Learning outcomes

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 RV. CDF and discrete RV.
	Transformation of continuous RV: 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.
	Two-dimensional transformations: fundamental theorem.
	Changes of dimension.
	Correlation and regression.
Estimation and limit theorems	Sample and population.
	Estimators.
	Estimation of mean and variance.
	Sequences of RV. 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	24	24	48
Problem solving	13.5	28	41.5
Practices through ICT	14	7	21
Problem and/or exercise solving	2	7	9
Objective questions exam	0.5	2	2.5
Essay questions exam	2	26	28

*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 in big group.
	The 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.
	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 and specific questionnaires for each topic will be used. The 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 personalized tutorials at specific times established for this purpose at the beginning of the course. This schedule will be published on the subject's website. Tutorials may also be carried out online by appointment.
Problem solving	Students will have the opportunity to attend personalized tutorials at specific times established for this purpose at the beginning of the course. This schedule will be published on the subject's website. Tutorials may also be carried out online by appointment.
Practices through ICT	Students will have the opportunity to attend personalized tutorials at specific times established for this purpose at the beginning of the course. This schedule will be published on the subject's website. Tutorials may also be carried out online by appointment.

Assessment

	Description	Qualification	Training and Learning Results	
Problem and/or exercise solving	Students must solve a problem individually, three occasions along the course	37.5	B3 B4	C1
Objective questions exam	Students must answer a multiple choice test individually.	12.5	B3 B4	C1
Essay questions exam	Individual final exam.	50	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 Final exam assessment.

Continuous assessment is based on several tasks. 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.

Students who choose Continuous assessment:

Several tasks are evaluated with a grade between 0 and 10. 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.

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

Task 1: Weight 12.5%. Two parts, both with the same weight:

  Part 1: Individual resolution of a problem

  Part 2: Correction of the problem solved from somebody else

Task 2: Individual resolution of a multiple choice test. Weight 12.5%

Task 3: Individual resolution of a problem. Weight 12.5%

Task 4: Individual resolution of a problem. Weight 12.5%

Last Task: Final exam. A reduced version of the exam to be carried out by the students who choose Final exam assessment. Weight 50%

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.

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

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

The final grade for students who choose Continuous assessment will be calculated as the mean between the final exam and the average of the previous tasks marks. To minimize the impact of a possible miss on a task, the average of these will be computed excluding the worst grade.

Students who choose Final exam assessment or End-of-program call:

In this cases students will carry out one only final exam. This exam will be graded between 0 and 10, and this value will be the final grade of the student.

Second call

At the Second call, available only for students who have not passed the subject previously, students have to choose between Continuous and Final exam assessment, regardless of the system they chose at the First call. The choice has to be made before the exam is carried out. 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**, 10 ed, 2020
A Mojón, I. Alonso y JR Fernández, **Vídeos de la asignatura de Probabilidad y Estadística**, 1 ed, 2014
X. Rong Li, **Probability, Random Signals and Statistics**, 1 ed, 1999
R. Cao y otros, **Introducción a la estadística y sus aplicaciones**, 1 ed, 2001
Complementary Bibliography
H. Stark y J.W. Woods, **Probability, Random Processes, and estimation theory for engineers**, 2 ed, 1994
D. Peña, **Estadística, modelos y métodos. Tomo 1: Fundamentos**, 2 ed, 1991
P. Peebles, **Principios de probabilidad, variables aleatorias y señales aleatorias**, 4 ed, 2006
A. Papoulis, **Probability, random variables and stochastic processes**, 4 ed, 2002
A. Blanco y S. Pérez-Díaz, **Modelos aleatorios en ingeniería**, 1 ed, 2015

Recommendations
Subjects that continue the syllabus
Basics of bioengineering/V05G300V01915
Data Communication/V05G301V01204
Computer Networks/V05G301V01210
Signal Transmission and Reception Techniques/V05G301V01208

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

Contingency plan

Description
If teaching were not face-to-face, the planning will be maintained, both for groups A and groups B, but virtual teaching would be used.

In addition to the virtual classes and to facilitate student learning and autonomous work, they will have all the theoretical content of the subject recorded in short videos (in Spanish), as well as all the slides or any other material employed for the lectures and the possibility of online tutoring.

Regarding the assessment, and providing that it would not be possible to carry out exams in-person, the following modifications would be made:

- All the continuous assessment tests would be maintained, except for Part 2 of Task 1, which would be eliminated. In this case, what is described as Part 1 of Task 1 would have all the weight expected for that Task 1.

- The final exam would be the same for all students, that is, those who chose continuous assessment would not take a reduced version of it.

- As long as the four previous planned tasks could have been carried out the average of these will be calculated excluding the worst of the grades. Otherwise, it will be calculated with all the available task grades.

- The final grade of the students who chose continuous assessment will be calculated as the highest between the final exam grade and the average between the final exam grade and the average grade of the previous tasks.

The rest of the conditions of the assessment system will not be modified.