



## IDENTIFYING DATA

### Mathematics: Algebra and statistics

Subject	Mathematics: Algebra and statistics			
Code	V12G380V01103			
Study programme	Degree in Mechanical Engineering			
Descriptors	ECTS Credits	Type	Year	Quadmester
	9	Basic education	1st	1st
Teaching language	Spanish Galician English			

Department

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General description The aim of this course is to provide the student with the basic techniques in Algebra and Statistics that will be necessary in other courses of the degree.

English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.

## Competencies

Code

CG3 CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.

CE1 CE1 Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.

CT2 CT2 Problems resolution.

CT5 CT5 Information Management.

CT6 CT6 Application of computer science in the field of study.

CT9 CT9 Apply knowledge.

## Learning outcomes

Learning outcomes

Competences

Acquire the basic knowledge on matrices, vector spaces and linear maps.

CG3

CE1

Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.

CG3

CE1

CT2

Understand the basic concepts on eigenvalues and eigenvectors, vector spaces with scalar product and quadratic forms used in other courses and solve basic problems related to these subjects.	CG3	CE1	CT2 CT9
Perform basic exploratory analysis of databases.	CG3	CE1	CT5
Model situations under uncertainty by means of probability.	CG3	CE1	CT2
Know basic statistical models and their application to industry and perform inferences from data samples.	CG3	CE1	CT2 CT9
Use computer tools to solve problems of the contents of the course.	CG3		CT2 CT6

## Contents

Topic	
Preliminaries	The field of complex numbers.
Matrices, determinants and systems of linear equations.	Definition and types of matrices. Matrices operations. Elementary transformations, row echelon forms, rank of a matrix. Inverse and determinant of a square matrix. Consistency of systems of linear equations and their solutions.
Vector spaces and linear maps.	Vector space. Subspaces. Linear independence, basis and dimension. Coordinates, change of basis. Basic notions on linear maps.
Eigenvalues and eigenvectors.	Definition of eigenvalue and eigenvector of a square matrix. Diagonalization of matrices by similarity transformation. Applications of eigenvalues and eigenvectors.
Vector spaces with scalar product and quadratic forms.	Vectorial spaces with scalar product. Associated norm and properties. Orthogonality. Gram-Schmidt orthonormalization process. Orthogonal diagonalization of a real and symmetric matrix. Quadratic forms.
Probability.	Concept and properties. Conditional probability and independence of events. Bayes Theorem.
Discrete random variables and continuous random variables.	Definition of random variable. Types of random variables. Distribution function. Discrete random variables. Continuous random variables. Characteristics of a random variable. Main distributions: Binomial, Geometric, Poisson, Hypergeometric, Uniform, Exponential, Normal. Central Limit Theorem.
Statistical inference.	General concepts. Sampling distributions. Point estimation. Confidence intervals. Tests of hypotheses.
Regression.	Scatterplot. Correlation. Linear regression: regression line. Inference about the parameters of the regression line.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	40	81	121
Problem solving	12	12	24
Laboratory practical	24	12	36
Autonomous problem solving	0	40	40
Essay questions exam	4	0	4

\*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 lecturer will explain the contents of the course.
Problem solving	Problems and exercises will be solved during the classes. Students will also solve similar problems and exercises.
Laboratory practical	Computer tools will be used to solve problems related to the contents of the course.
Autonomous problem solving	Student will have to solve problems and exercises by their own.

<b>Personalized assistance</b>	
<b>Methodologies</b>	<b>Description</b>
Laboratory practical	
Lecturing	
Problem solving	
Autonomous problem solving	

<b>Assessment</b>					
	Description	Qualification	Evaluated Competences		
Problem solving	Students will make several mid-term exams of Algebra and Statistics during the course.	40 por cento en Álgebra; 20 por cento en Estadística	CG3	CE1	CT2 CT5 CT6 CT9
Essay questions exam	At the end of the semestre there will a final exam of Algebra and a final exam of Statistics.	60 por cento en Álgebra; 80 por cento en Estadística	CG3	CE1	CT2 CT5 CT6 CT9

### **Other comments on the Evaluation**

At the end of the first quarter, once the mid-term exams and the final exams have been done, the student will have a grade out of 10 points in Algebra (A) and a grade out of 10 points in Statistics (S). The final qualification of the subject will be calculated as follows:

- If both grades, A and S, are greater or equal to 3.5, then the final grade will be  $(A+S)/2$ .
- Any of the grades A or S is less than 3.5, then the final qualification will be the minimum of the quantities  $(A+S)/2$  and 4.5.

The students who are exempted by the School from taking the mid-term exams will be evaluated through a final exam of Algebra (100% of the grade of this part) and a final exam of Statistics (100% of the grade of this part). The final grade will be calculated according to procedure described above.

A student will be assigned to NP ("absent") if he/she is absent in both final exams (i.e. Algebra and Statistics); otherwise he/she will be graded according the the procedure described above.

The assessment in the second call (June/July) will be done by means of a final exam of Algebra and a final exam of Statistics (100% of the grade of each part). The final grade will be calculated according to procedure described above.

If at the end of the first quarter a student obtains a grade equal to or greater than 5 out of 10 in any of the parts of the subject (Algebra or Statistics) then he/she will keep this grade in the second call (June/July) without retaking the corresponding exam.

**Ethical commitment:** Students are expected to commit themselves to an adequate and ethical behaviour. Students showing unethical behaviours (exam cheating, plagiarism, unauthorized use of electronic devices, etc.) will be rated with the minimum grade (0.0) in the current academic year.

As a general rule, the use of any electronic device for the assessment tests is not allowed unless explicitly authorized.

### **Sources of information**

#### **Basic Bibliography**

- Lay, David C., **Álgebra lineal y sus aplicaciones**, 4ª,
- Nakos, George; Joyner, David, **Álgebra lineal con aplicaciones**, 1ª,
- de la Villa, A., **Problemas de álgebra**, 4ª,
- Cao, Ricardo et al., **Introducción a la Estadística y sus aplicaciones**, 1ª,
- Devore, Jay L., **Probabilidad y estadística para ingeniería y ciencias.**, 8ª,
- Devore, Jay L., **Probability and statistics for engineering and sciences**, 8ª,

#### **Complementary Bibliography**

### **Recommendations**

#### **Subjects that are recommended to be taken simultaneously**

Mathematics: Calculus I/V12G380V01104

