IDENTIFYING DATA

Mathematics: Algebra and statistics

Subject	Mathematics: Algebra and statistics				
Code	V12G320V01103				
Study programme	Degree in Electrical Engineering				
Descriptors	ECTS Credits		Choose	Year	Quadmester
	9		Basic education	1st	1st
Teaching language	Spanish Galician English				
Department					
Coordinator	Pardo Fernández, Juan Carlos Castejón Lafuente, Alberto Elias				
Lecturers	Castejón Lafuente, Alberto Elias Fernández García, José Ramón Fiestras Janeiro, Gloria Fonseca Bon, Cecilio Godoy Malvar, Eduardo Gómez Rúa, María Lorenzo Picado, Leticia Luaces Pazos, Ricardo Martín Méndez, Alberto Lucio Martínez Brey, Eduardo Matías Fernández, José María Pardo Fernández, Juan Carlos Rodríguez Campos, María Celia Suárez Rodríguez, María Carmen				
E-mail	juancp@uvigo.es acaste@uvigo.es				
Web	http://faitic.uvigo.es				
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.				

Competencies

Code	
B3	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.
C1	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.
D2	CT2 Problems resolution.
D5	CT5 Information Management.
D6	CT6 Application of computer science in the field of study.
D9	CT9 Apply knowledge.

Learning outcomes

Expected results from this subject	Training and Learning Results		
Acquire the basic knowledge on matrices, vector spaces and linear maps.	B3	C1	
Handle the operations of the matrix calculation and use it to solve problems to systems of linear equations.	B3	C1	D2

Understand the basic concepts on eigenvalues and eigenvectors, vector spaces with scalar product and quadratic forms used in other courses and sove basic problems related to these subjects.	B3	C1	D2 D9
Perform basic exploratory analysis of databases.	B3	C1	D5
Model situations under uncertainty by means of probability.	B3	C1	D2
Know basic statistical models and their application to industry and perform inferences from data samples.	B3	C1	D2 D9
Use computer tools to solve problems of the contents of the course.	B3		D2 D6

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.
Descriptive statistics and regression.	Concept and uses of the statistics. Variables and attributes. Types of variables. Tables of frequencies and graphical representations. Position and dispersion measures. Analysis of bivariate data. Linear regression. Correlation.
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.

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	40	81	121
Troubleshooting and / or exercises	12	12	24
Laboratory practises	24	12	36
Autonomous troubleshooting and / or exercises	0	40	40
Long answer tests and development	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
Master Session	The lecturer will explain the contents of the course.
Troubleshooting and / or exercises	Problems and exercises will be solved during the classes. Students will also solve similar problems and exercises.
Laboratory practises	Computer tools will be used to solve problems related to the contents of the course.

Autonomous troubleshooting and / or exercises	Student will have to solve problems and exercises by their own.

Personalized attention

Methodologies	Description
Laboratory practises	
Master Session	
Troubleshooting and / or exercises	
Autonomous troubleshooting and / or exercises	

Assessment

	Description	Qualification	Training and Learning Results		
Troubleshooting and / or exercises	Students will make several mid-term exams of Algebra and Statistics during the course.	40 por cento en Álxebra; 20 por cento en Estatística	B3	C1	D2 D5 D6 D9
Long answer tests and development	At the end of the semestre there will a final exam of Algebra and a final exam of Statistics.	60 por cento en Álxebra; 80 por cento en Estatística	B3	C1	D2 D5 D6 D9

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.

Responsible lecturers by group:

Group A: Eduardo Godoy Malvar / Gloria Fiestras Janeiro

Group B: Alberto Martín Méndez / José María Matías Fernández

Group C: Alberto Castejón Lafuente / José María Matías Fernández

Group D: Cecilio Fonseca Bon / Celia Rodríguez Campos

Group G: José Ramón Fernández García / María Gómez Rúa

Group H: José Ramón Fernández García / Ricardo Luaces Pazos

Group I: Cecilio Fonseca Bon / Juan Carlos Pardo Fernández

Group J: Eduardo Martínez Brey / Ricardo Luaces Pazos

Group K: Cecilio Fonseca Bon / José María Matías Fernández

Group L: Alberto Castejón Lafuente / Leticia Lorenzo Picado

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 1/V12G380V01104