UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2015/16
Subject (*)	Álxebra lineal II		Code	632G02008
Study programme	Grao en Tecnoloxía da Enxeñaría Civil			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	FB	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Métodos Matemáticos e de Representación			
Coordinador	Fuentes Garcia, Luis	E-mail	luis.fuentes@udc.es	
Lecturers	Fuentes Garcia, Luis Taboada Vazquez, Raquel Villar Ferrer, Juan	E-mail	luis.fuentes@udc.es raquel.taboada@udc.es j.villar@udc.es	
Web	caminos.udc.es/info/asignaturas/grado_tecic/101/AL2/index.html			
General description	The aim of the course is to provide a solid background in linear algebra and mathematical foundation engineering. This second part of the course focuses on studying the geometrical applications of the theory of vectorial spaces.			

Study programme competences / results	
Code	Study programme competences / results
A1	Capacidad para plantear y resolver los problemas matemáticos que puedan plantearse en el ejercicio de la profesión. En particular, conocer, entender y utilizar la notación matemática, así como los conceptos y técnicas del álgebra y del cálculo infinitesimal, los métodos analíticos que permiten la resolución de ecuaciones diferenciales ordinarias y en derivadas parciales, la geometría diferencial clásica y la teoría de campos, para su aplicación en la resolución de problemas de Ingeniería Civil.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamiento crítico, lógico y creativo.
C1	Reciclaje continúo de conocimientos en el ámbito global de actuación de la Ingeniería Civil.
C4	Entender y aplicar el marco legal de la disciplina.
C6	Compresión de la necesidad de analizar la historia para entender el Presente.
C8	Facilidad para la integración en equipos multidisciplinares.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To know and to understand the basic theory of linear algebra required in civil engineering , especially the geometric applications of vector spaces.	A1		
Know, understand and manage elementary mathematical notation.	A1	B3	
Learn to express with precision and rigor.	A1		C1
Learn to use the basic techniques of mathematical reasoning.	A1	B2 B3	
Understanding the importance of justifying the thesis and results in science	A1	B3	C4 C6
Develop critical thinking and analytical skills .	A1	B2 B3	C4 C8
Learn to pose and solve mathematical problems of Linear Algebra.	A1	B2 B3	

Contents

Topic	Sub-topic
Bilinear maps and homogenous tensors.	1. Bilinear maps and quadratic forms. 1.1 Bilinear maps. 1.2 Bilinear forms. 1.3 Quadratic forms. 1.4 Real quadratic forms. 2. Homogenous tensors and duality. 2.1 Duality. 2.2 Homogenous tensor. 2.3 Operations with homogenous tensors. 2.4 Simmetry and skewsimmetry.
Euclidean vectorial spaces.	1. Introduction to euclidean spaces. 1.1 Scalar product. 1.2 Norm of a vector. Properties. 1.3 Angle between two vectors. 2. Orthogonality. 2.1 Orthogonal vectors. 2.2 Orthogonal systems. Gram-Schmidt method. 2.3 Singularties of orthonormal basis. 2.4 Orthogonal projection. 2.5 Symmetric endomorphisms. 3. Orthogonal maps. 3.1 Definition. 3.2 Properties. 3.3 Eigenvalues and eigenvectors of an orthogonal map. 3.4 Orientation of a basis 3.5 Inverse and direct orthogonal maps. 3.6 Classiication of orthogonal maps in two and three dimensions. 4. Vectorial product and triple product. 4.1 Definition. 4.2 Properties.
Affine geometry.	1. Affine space. 1.1 Definition and properties. 1.2 System of reference. 1.3 Affine varieties. 1.4 Pencils of affine varietes. 1.5 Distances and angles between affine varieties. 1.6 Affine transformations. 2. Projective space. 2.1 Introduction. 2.2 Homogeneous coordinates. 2.3 Proper points and points at infinity. 2.4 Reference change in homogeneous coordinates. 2.5 Equations of affine varieties in homogeneous coordinates.

Conics and quadric surfaces.	1. Conics. 1.1 Definition and equations. 1.2 Intersections of a conic and a line. 1.3 Polarity. 1.4 Important potins and lines of a conic. 1.5 Description of nondegenerated conics: ellipse, parabola e hyperbola. 1.6 Change of reference. 1.7 Classification of conics. Reduced equation. 1.8. Pencils of conics. 2. Quadric surfaces. 2.1 Definition and equations. 2.2 Intersections of a quadric surface and a line. 2.3 Polarity. 2.4 Change of reference. 2.5 Important potins, lines and planes of a quadric surface. 2.6 Classification of quadric surfaces. Reduced equation. 2.7 Description of quadric surfaces of rank 3 and 4.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 B2 B3 C1	27	32	59
Seminar	A1 B2 B3	27	33	60
Mixed objective/subjective test	A1 B2 B3	3	3	6
Workbook	A1 B2 B3	0	10	10
Problem solving	A1 B2 B3	0	10	10
Personalized attention		5	0	5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	New mathematic concepts will be developed from examples familiar for the students, or explaining the questions are wished to be solved with them; from this their common caracthers will be abstracted causing its more accuracy deffinition. The theory which allows to solve the questions described at the beginning will be developed after. Students participation is desirable, sharing their doubts or comments as the class progresses.
Seminar	Simultaneously to the theoretical development of the matter collections of exercics are given. The goal is allowing students to practise the knowledge adquierd at theorical classes. At seminars the most important problems will be discussed.
Mixed objective/subjective test	Exam where concepts are methods of the subjets are evaluated.
Workbook	Before the beginning of each item, some notes about the contents are avaiable for the students. The notes are intended as a complement of teacher's explanations. A previous reading of students familiarize them with an outline of what they will study.
Problem solving	Each student must solve individually some of the proposed problems.

Personalized attention	
Methodologies	**Description**
Problem solving Guest lecture / keynote speech Seminar	

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Problem solving	A1 B2 B3	Each student must solve individually some of the proposed problems.	20
Mixed objective/subjective test	A1 B2 B3	Exam where concepts are methods of the subjets are evaluated.	80
Others			

Assessment comments

Sources of information	
Basic	- Juan de Burgos (2000). Álgebra Lineal. McGraw-Hill - Fuentes, Salete y Cruces (1980). Álgebra vectorial y Tensorial. ETSICCP Madrid - F. Granero (1992). Álgebra y Geometría Analítica. McGraw-Hill - Luis Fuentes García (2005-). Apuntes y ejemplos (http://caminos.udc.es/info/asignaturas/101/index.html). A Coruña - A. de la Villa (1994). Problemas de Álgebra. CLAGSA - Anzola, Caruncho y Pérez-Canales (1981). Problemas de Álgebra (Tomos 6,7). Madrid Â
Complementary	- S.I. Grossman (1995). Álgebra lineal. McGraw-Hill - J. Rojo (2001). Álgebra lineal. McGraw-Hill - M. Castellet e I. Llerena (1991). Álgebra lineal y geometría. Reverté - J. Rojo e I. Martín (1994). Ejercicios y problemas de álgebra. McGraw-Hill - M. García Galludo y otros (1984). Problemas de álgebra y analítica. Madrid - F. González Posada (1971). Problemas de estructuras algebraicas tensoriales. Madrid

Recommendations
Subjects that it is recommended to have taken before
Cálculo infinitesimal I/632G02001 Álxebra lineal I/632G02007
Subjects that are recommended to be taken simultaneously
Cálculo infinitesimal II/632G02002
Subjects that continue the syllabus
Fundamentos de mecánica computacional/632G02015 Ecuacións diferenciais/632G02017
Other comments