SUBJECT TEACHING GUIDE

G377 - Linear Algebra And Geometry

Degree in Energy Resources Engineering

Academic year 2021-2022

1. IDENTIFYING DATA					
Degree	Degree in Energy Resources Engineering			Type and Year	Core. Year 1
Faculty	School of Mines and Energy Engineering				
Discipline	Subject Area: Mathematics Basic Training Module				
Course unit title and code	G377 - Linear Algebra And Geometry				
Number of ECTS credits allocated	6	Term		Semester based (1)	
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION
Name of lecturer	ANA CASANUEVA VICENTE
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Other lecturers	

3.1 LEARNING OUTCOMES
- To develop logical mathematical reasoning and the ability to associate practical problems with the solution of linear equation systems, eigenvectors and eigenvalues calculation and the concepts of matrices, vector spaces and linear transformations, as well as problems related to Euclidean Geometry.
- To have a good command of basic concepts related to linear algebra , particularly matrices, determinants, vector spaces, vector subspaces, linear independence, bases and dimension, dot product, least squares, linear transformations, kernel an image, eigenvalues and eigenvectors, characteristic polynomial.
- To successfully use deductive reasoning methods associated with linear equation systems , vector spaces, Euclidean vector spaces, linear transformations, eigenvalues and eigenvectors, as well as their characteristics and properties.
- To apply the acquired knowledge to real situations and problems , related to their professional career and other related subjects.

4. OBJECTIVES

- To develop logical mathematical reasoning and the ability to relate practical problems to the solution of systems of linear equations, the calculation of eigenvalues and vectors and the notions of matrices, vector spaces and linear transformations, as well as problems of Euclidean Geometry.
- To understand and have good command of the basic concepts related to linear algebra , in particular, the notions of matrices, determinants, vector spaces, vector subspaces, linear independence, bases and dimension, dot product, least squares, linear transformations, kernel and image, eigenvalues and eigenvectors, characteristic polynomial.
- To apply the acquired knowledge to real situations and problems , linked to their professional career and other related fields.
- To acquire skills in the use of mathematical software as an aid in the resolution of problems .
- To get used to consulting bibliographical references to obtain information .

6. COURSE ORGANIZATION	
	CONTENTS
1	BLOCK I: MATRICES. DETERMINANTS. SYSTEMS OF LINEAR EQUATIONS LESSON 1. MATRICES AND DETERMINANTS 1.1. Matrix Algebra 1.2. Echelon and reduced forms of a matrix LESSON 2. SYSTEMS OF LINEAR EQUATIONS 2.1. Matrix form of linear equation systems. 2.2. Resolution of linear systems by different methods.
2	BLOCK II: FINITE-TYPE VECTOR SPACES LESSON 3. VECTOR SPACES 3.1. Definition of vector space Properties. Examples 3.2. Vectorial subspaces. Operations with subspaces 3.3. Linear dependence and independence 3.4. Generator systems. Bases and dimension 3.5. Coordinates and change of base 3.6. Direct sum and supplementary subspaces LESSON 4. EUCLIDEAN SPACE 4.1. Definition of Euclidean space. Properties. Examples 4.2. Orthogonal subspaces 4.3. Orthogonal projections 4.4. Calculation of orthogonal bases. Orthonormal base 4.5. Method of least squares 4.6. Approximation of a continuous function in an interval by a polynomial 4.6. Geometric applications
3	BLOCK III. LINEAR APPLICATIONS AND DIAGONALIZATION LESSON 5. LINEAR APPLICATIONS 5.1. Linear applications. Properties 5.2. Kernel and image 5.3. Classification of linear applications 5.4. Matrix associated with a linear application 5.5. Matrix of an application on different bases 5.6. Equivalent matrices LESSON 6. MATRIX DIAGONALIZATION 6.1. Introduction. Similar matrices 6.2. Eigenvalues and eigenvectors 6.3. Diagonalization of matrices
4	BLOCK IV. GEOMETRY. APPLICATIONS LESSON 7. APPLICATIONS TO GEOMETRY 7.1. Geometric applications of matrix diagonalization. Isometries in R2 and R3. 7.2. Introduction to conical shapes and classification

7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Laboratory (computer) practices	Laboratory evaluation	No	No	15,00
Tests	Written exam	No	Yes	15,00
Theoretical and practical examination	Written exam	Yes	Yes	60,00
Coursework and reports	Others	No	No	10,00
TOTAL				100,00

Observations

A student can go to the extraordinary examination only to those recoverable parts that he /she failed (score of less than 5 out of 10 points).
The final score will be 4.9 (fail) for those students who, while having a mean score of above 5, got less than the minimum score in any of the evaluated activities.
In the activities with a specific format (template for practical reports, programming templates, reserved space in written exams), the lack of adaptation to the format will be punished. Likewise, unjustified answers, inaccurate use of mathematical terminology and concepts and the lack of basic mathematical competences will be penalized.

Observations for part-time students

The subject can be entirely followed through the Moodle website. Those students enrolled part-time, who request it at the beginning of the term, may have a single evaluation, which means having all the theoretical and practical exams of all the subject blocks in the ordinary examination. It is mandatory to attend all in-person evaluation activities (tests and computer practices), to ensure the evaluation of the same concepts and competences as their classmates.

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

Apuntes de la asignatura en el Open Course Ware de la Universidad de Cantabria . 2010.
https://ocw.unican.es/course/view.php?id=200

Larson R., Edwards B.H., Falvo D.C. 2004. Álgebra Lineal Pirámide. ISBN: 84-368-1878-4.
http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=226698

Kolman B., Hill D.R. 2006. Álgebra Lineal, 8ªEdición. Pearson. ISBN: 970-26-0696-9.
http://catalogo.unican.es.unican.idm.oclc.org/cgi-bin/abnetopac/?TITN=239995