

## SUBJECT TEACHING GUIDE

### G387 - Linear Algebra And Geometry

#### Degree in Mining Resources Engineering First Degree in Mining Resources Engineering

Academic year 2022-2023

| 1. IDENTIFYING DATA              |                                                                                        |                  |                    |                  |                              |
|----------------------------------|----------------------------------------------------------------------------------------|------------------|--------------------|------------------|------------------------------|
| Degree                           | Degree in Mining Resources Engineering<br>First Degree in Mining Resources Engineering |                  |                    | Type and Year    | Core. Year 1<br>Core. Year 1 |
| Faculty                          | School of Mines and Energy Engineering                                                 |                  |                    |                  |                              |
| Discipline                       | Subject Area: Mathematics<br>Basic Training Module                                     |                  |                    |                  |                              |
| Course unit title and code       | G387 - 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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| Office           | E.T.S. de Ingenieros Industriales y de Telecomunicación. Planta: - 4. DESPACHO (S4017) |  |  |  |  |
| 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, eigenvalues and eigenvectors 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        | <p><b>BLOCK I: MATRICES. DETERMINANTS. LINEAR EQUATIONS SYSTEMS</b></p> <p>Matrix Algebra. Elemental matrices. Matrices factorization: LU and Cholesky. Linear equation systems. Gaussian elimination.</p> |
| 2        | <p><b>BLOCK II: VECTOR SPACES</b></p> <p>Vector space. Base. Vector subspace. Euclidean space. Approximation of a continuous function in an interval. Least squares approximation.</p>                     |
| 3        | <p><b>BLOCK III. LINEAR APPLICATIONS AND DIAGONALIZATION OF ENDOMORPHISMS</b></p> <p>Linear applications. Kernel and image- Invariant subspaces. Diagonalization of matrices by similarity.</p>            |
| 4        | <p><b>BLOCK IV. GEOMETRY. APPLICATIONS</b></p> <p>Definitions and examples. Isometries in <math>R^2</math> and <math>R^3</math>.</p>                                                                       |

| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |             |           |        |
| <p>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).</p> <p>The global score will be the lowest value between 4.9 and the weighted average of all evaluation activities for those students who got less than the minimum score in any of the evaluated activities.</p> <p>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.</p> |                       |             |           |        |
| Observations for part-time students                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |             |           |        |
| <p>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.</p>                                                                                                                                                                                                                                      |                       |             |           |        |

## 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>