COURSE NAME

Name: **MATHEMATICS I**
Code: 101120
Curriculum: **DEGREE IN CIVIL ENGINEERING** Year: 1
Name of the module to which it belongs: BASIC TRAINING MODULE
Subject: MATHEMATICS
Nature: BASIC Duration: FIRST SEMESTER
ECTS Credits: 6 Classroom hours: 60
Face-to-face classroom percentage: 40% Non-contact hours: 90
Online platform: http://moodle.uco.es/

FACULTY DETAILS

Name: RIOS LOPEZ, FCO. JAVIER DE LOS (Coordinator)
Department: MATHEMATICS area: APPLIED MATHEMATICS
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SKILLS

CB4	Solve problems within the study area of Civil Engineering.
CEB1	Ability for solving mathematical problems that may arise in Engineering. Skills for applying knowledge on: linear algebra, geometry, numerical methods, numerical algorithms, statistics and optimisation.

OBJECTIVES

Students should be able to:

1. **Operate with vectors, bases, subspaces, matrices and linear applications. Manage elementary calculus in complex variable. Apply the use of matrices to calculus of different concepts. Calculate eigenvalues and eigenvectors.**
2. **Understand the positioning of linear varieties.**
3. **Understand conics and quadrics.**
4. **Understand and apply Linear programming for the optimisation of functions.**
5. **Synthetize and descriptively analyse data sets.**

CONTENTS:

1. Theoretical contents

Block 1: Algebra and Geometry

Unit 1. Matrices and Determinants.

Vectors, matrices and determinants: general concepts. Basic operations with matrices. Determinant of a matrix: definition and properties. Rank and inverse of a matrix.

Unit 2. Linear equation systems.

Linear equation systems. Homogeneous systems. Rouché-Capelli theorem. Calculation of solutions: Cramer's rule and Gaussian elimination.

Unit 3. Vector spaces and linear transformations.

Vector spaces: definition and basic properties. Subspaces. Linear combination and generated space. Linear independence. Basis and dimension of vector spaces. Linear applications: definition. Properties of linear applications: image and nucleus. Linear applications and matrices. Composition of linear applications and matrix multiplication.

Unit 4. Diagonalization of matrices.

Characteristic polynomial. Eigenvalues and Eigenvectors. Diagonalization of matrices.

Unit 5. Euclidean vector spaces.

Euclidean vector space. Scalar product. Vector norm. Distance and angle. Multiplication of vectors and mix product.

Unit 6. Euclidean geometry.

Unit 7. Conics and Quadrics.

Definition of conics. Classification of conics. Notable elements of conics. Definitions and classification of quadrics.

Unit 8. Complex numbers.

Construction of real numbers, due to algebraic needs. The body of complex numbers: specific case of en . Representation geometry of complex numbers. imaginary unit i. Absolute value of a complex number. Complex exponentials: properties. Polar form of a complex number. Integer powers and roots of complex numbers. de Moivre's formula.

Block 2: Optimisation

Unit 9. Linear programming.

Historical introduction. The problem of linear programming: definitions and matrix expression. Convex groups. Geometrical solving of the problem of linear programming with two variables. Simplex Method.

Block 3: Statistics and Probability

Unit 10. Descriptive Statistics.

Definitions Data arrangement. Graphical representation of data. Measures of central trend. Dispersion measures. Asymmetry and kurtosis measures.

Unit 11. Bidimensional statistical variable.

Bidimensional statistical variable. Data arrangement. Graphical representation of data. Margin distributions. Conditional distributions. Moments.

Unit 12. Regression and correlation.

Regression. Regression lines. Regression straight line. Regression coefficient. Correlation coefficient.

Unit 13. Combinatorics.

2. Practical contents.

Solving exercises and problems related to theoretical contents.