



## GEOMETRY AND ALGEBRA

<b>Enrollment year</b>	2016/2017
<b>Academic year</b>	2016/2017
<b>Regulations</b>	DM270
<b>Academic discipline</b>	MAT/03 (GEOMETRY)
<b>Department</b>	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
<b>Course</b>	CIVIL AND ENVIRONMENTAL ENGINEERING
<b>Curriculum</b>	PERCORSO COMUNE
<b>Year of study</b>	1°
<b>Period</b>	1st semester (26/09/2016 - 13/01/2017)
<b>ECTS</b>	6
<b>Lesson hours</b>	60 lesson hours
<b>Language</b>	ITALIAN
<b>Activity type</b>	WRITTEN AND ORAL TEST
<b>Teacher</b>	BONSANTE FRANCESCO (titolare) - 6 ECTS
<b>Prerequisites</b>	<p>The same mathematics prerequisites for enrollment into the Engineering Faculty.</p> <p>In particular, the following issues are required</p> <ul style="list-style-type: none"><li>elementary set theory;</li><li>basic algebra: monomials/polynomials, polynomial division, equations and inequations (inequalities) of degree 1 or 2, also for fractions of polynomials; functions;</li><li>basic trigonometry: goniometric functions, trigonometric equations and inequations, double- and half-angle formulae etc., laws for right and oblique triangles;</li><li>Euclidean basic 2D 3D geometries, including area and volume formulas for mosto common figures, parallelism and orthogonality between straight lines and/or planes, parallelograms.</li></ul>
<b>Learning outcomes</b>	<p>This is a basic course on Linear Algebra and Analytic Geometry. Particular emphasis will be given to topics useful in other disciplines,</p>

with a great deal of motivation and many computational examples. A tutoring staff, composed by experienced graduate or undergraduate students, provides an expert help and support for students attending the course.

#### Course contents

##### Preliminaries

Polynomials and algebraic equations. Complex numbers and the Fundamental Theorem of Algebra.

##### Linear Algebra

Vector spaces, vectors of  $\mathbb{R}^n$ , linear subspaces; linear span of a set of vectors; spanning sets and linear independence, basis, coordinates, and dimension. Operations with matrices, determinant and rank of a matrix, inverse of a matrix. Linear systems, Rouché-Capelli and Cramer theorems, Gauss elimination method, representation of the set of the solutions of a linear system. Linear mappings between vector spaces, kernel and image, matrix associated with a linear mapping. Eigenvalues and eigenvectors of a linear operator, diagonalisation of a linear operator. Inner product in  $\mathbb{R}^n$ , orthonormal basis, Gram-Schmidt process. Orthogonal matrices. Real quadratic forms. Spectral theorem: real symmetric matrices and orthogonal diagonalisation.

Coordinate systems in 2- and 3-dimensional spaces; straight lines and planes. Canonical forms of plane conics. Quadric surfaces.

#### Teaching methods

Lectures (hours/year in lecture theatre): 60

Practical class (hours/year in lecture theatre): 0  
Practicals / Workshops (hours/year in lecture theatre): 0

#### Recommended or required readings

F.Bisi, F.Bonsante, S. Brivio. Lezioni di Algebra Lineare con Applicazioni alla Geometria Analitica. Edizioni La Dotta.

#### Assessment methods

The final exam consists of a written and an oral test. Both have to be passed within the same session. A minimum grade in the written test will be required to be admitted to the oral test. Under certain specific conditions, the student can be exonerated from oral test.

#### Further information

#### Sustainable development goals - Agenda 2030

[\\$|b| legenda sviluppo sostenibile](#)