UNIVERSITA' DEGLI STUDI MEDITERRANEA DI REGGIO CALABRIA

Subject Code   56T001
Subject Name   Geometry
Professor   Gioia Failla

Department: DICEAM
Degree course: in Civil-Environmental Engineering
Class: L7
Type of educational activity: basic
Disciplinary Area: Geometry
Scientific-Disciplinary Sector: MAT/03
Compulsory preliminary exams: NO
Course Year: I
Semester: I

ECTS: 6

Hours: 48

Synthetic description:
Linear algebra: matrices, determinants, systems of linear equations, vector spaces, linear maps, eigenvalues and eigenvectors, diagonalization of a matrix, scalar products.
Analytic geometry in dimension two three: equations of lines and planes and analytical study of their mutual positions; equations and study of curves and surfaces, with particular reference to conics and quadrics.

Acquisition of knowledge on:
Basic knowledge of linear algebra (matrices, determinants, systems of linear equations, vector spaces, linear maps, eigenvalues and eigenvectors, diagonalization of a matrix, scalar products) and analytical geometry in dimension two and three (equations of lines and plans and analytical study of their mutual positions; equations and study of curves and surfaces, with particular reference to conics and quadrics). Knowledge of the tools and techniques for the study of Linear Algebra Analytical Geometry. Ability to understand and use appropriate mathematical tools to solve geometric problems in the plane and space. Ability to communicate the knowledge gained through an appropriate scientific-technical language.

Evaluation method:
Written and oral tests

Student's independent work
For each credit 18 hours of individual study must be undertaken

Detailed course program
 Vector spaces (1 CFU):
Fields. Vector spaces . Finite dimensional vector spaces.Generators and bases of a vector space. Method of completion and bases of finitely generated vecto space.

Canonical bases. Components of a vector and changes of basis. Definition and examples of vector spaces. Law for the annulment of the product in vector spaces subspaces.

Systems of linear equations(1 CFU):
 Matrices. Reduction for rows of a matrix. Solving systems of linear equations. Product of matrices. Properties of the product.
 Invertible matrices. Transposed. Symmetric matrices and antisymmetric. Uniqueness of the inverse with demonstration. Inverse matrix of the matrix product AB.
The rank of a matrix. Determinants. Laplace theorem.Calculation of the determinants and properties.Determinants and invertible matrices.
 Adjoint matrix. Inverse of a matrix. Complements and applications: Cramer's Rule, Theorem Kronecher, Rouche-Capelli., linear transformation, Scalar productsSystems of linearly independent vectors.

Linear maps(1 CFU):
 definitions and examples. Kernel and image of a linear map.
 Linear maps and matrices. Similar matrices. Diagonalization.
 Eigenvalues and eigenvectors. Theorem on the linear independence of the eigenvectors. Characteristic polynomial. Scalar products. Angle between two vectors. Perpendicular and orthogonal bases, orthonormal bases. Affine reference in the plane and in space.

Geometry of the Cartesian plane (1 CFU):
 Cartesian reference. Straight lines of the Cartesian plane. Angle between two lines. Parameters directors and direction cosines.
 Intersections. Parallelism and perpendicularity.
 Sheaves of lines. Circles. Conic. Classification of affine conics. Canonical forms.
 Reduction to canonical form.

Geometry of Cartesian space(1 CFU):
 Points, lines and planes of Cartesian space.
 Intersections. Terms of parallelism and perpendicularity. Skew lines.
 Sheaves of planes. Spheres. Quadrics: definition. Canonical forms.
 Reduction to canonical form of the quadric.

Resources and main references
1. S. Greek, P. Valabrega, "Lessons of Geometry, Linear Algebra" vol. I Levrotto & Bella, Torino.
2. S. Greek, P. Valabrega, "Lessons of Geometry, Analytic Geometry," vol. II, Levrotto & Bella, Torino.
3)Bonacini, Cinquegrani,Marino, Linear Algebra solved exercises, cavallotto edition.
4) Bonacini, Cinquegrani,Marino, Analitic Geometry solved exercises, cavallotto editioni.
5)N. Chiarli, S. Greco, P. Valabrega, "100 Pagine di…Algebra lineare" Levrotto& Bella,
   Torino.
6)N. Chiarli, S. Greco, P. Valabrega, "100 Esercizi di…Algebra lineare" Levrotto& Bella, Torino.