FACULTY OF **ENGINEERING**

DEGREE COURSE: **INDUSTRIAL ENGINEERING BS**

SUBJECT: GEOMETRY

LECTURER: GENNARO AMENDOLA

E-mail: gennaro.amendola@uniecampus.it

OBJECTIVES

The course will give knowledge of Analytic Geometry and Linear Algebra needed to satisfactorily understand subsequent courses.

CONTENTS

LINEAR ALGEBRA

Vector spaces

Definition. Linear dependence and independence of vectors. Bases and dimension of a vector space. Subspaces. The space of Euclidean vectors. Linear maps.

Matrices

Definition. Operations. Determinant. Rank of a matrix. Transpose and inverse of a matrix. Linear maps and matrices. Eigenvalues and eigenvectors. Diagonalization.

Linear systems

Definitions. Homogeneous and non-homogeneous linear systems. Gaussian elimination. Cramer systems.

ANALYTIC GEOMETRY

Affine space

Definition. Coordinates. Vector, parametric and Cartesian equations of lines. Conditions of parallelism. Pencils. Coplanarity. Affine maps.

Euclidean space

Definition. Cartesian coordinate systems. Scalar product. Distance. Orthogonality. Angles. Vector product.

Projective space

Definition. Elements at infinity and projective extension of the plane and the space. Homogeneous coordinates. Equations of lines and planes.

Curves

Definition. Conics. Pencils. Polar duality. Classification.

Surfaces

Definition. Quadrics. Classification.

LEARNING OUTCOMES

At the end of the course, students will be able to:

- define a vector space,

- solve linear systems by means of matrices,
- compute the eigenvalues and the eigenvectors of a matrix,
- diagonalize a matrix,
- define an affine space,
- define the projective space,
- write lines and planes by means of vector, parametric and Cartesian equations,
- define the scalar and vector product,
- solve problems involving lines and planes in the Euclidean space,
- study plane curves, in particular conics,
- define the polar duality of a non-degenerate conic,
- study surfaces, in particular quadrics.

ASSESSMENT

Written exam: multiple choice and open questions

RECOMMENDED TEXTBOOKS

Further readings can be useful but not mandatory.

- Wikipedia: http://en.wikipedia.org/
- Wikibooks: http://en.wikibooks.org/
- Linear Algebra (wikibooks): http://en.wikibooks.org/wiki/Linear_algebra

Wikipedia and Wikibooks can be enough as textbooks, however free online books are available:

- http://www.freebookcentre.net/Mathematics/Linear-Algebra-Books.html
- http://www.e-booksdirectory.com/listing.php?category=46
- http://www.e-booksdirectory.com/listing.php?category=40

- Kenneth Kuttler, An Introduction To Linear Algebra
- Kenneth Kuttler, Linear Algebra
- Ruslan A. Sharipov, Course of analytical geometry (http://arxiv.org/abs/1111.6521)

Further reference textbooks are:

- Seymour Lipschutz – Marc Lipson, Linear Algebra (Schaum's Outline Series), McGraw-Hill
- Serge Lang, Introduction to Linear Algebra, Springer