UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	ENERGY ENGINEERING AND RENEWABLE ENERGIES
SUBJECT	GEOMETRY
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50292-Matematica, informatica e statistica
CODE	03675
SCIENTIFIC SECTOR(S)	MAT/03
HEAD PROFESSOR(S)	FAVACCHIO GIUSEPPE Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**FAVACCHIO GIUSEPPE** Tuesday 9:00 10:00

DOCENTE: Prof. GIUSEPPE FAVACCHIO

PREREQUISITES	Solving equations and inequalities of degree less than or equal to 3. Factorization of polynomials through elementary procedures such us the "common factor collection" method and the "difference of squares" formula. Goniometric functions: sine, cosine and tangent; and their value in the most important angles. Square root and absolute value of a real number. Elementary logic and elementary set theory. There is no formal prerequisite with other courses.
LEARNING OUTCOMES	Knowledge and understanding The student will acquire the knowledge of the main topics of algebra and linear geometry. In particular, definitions and theorems concerning the fundamental concepts of vector spaces, linear applications and endomorphisms, basic constructions and theorems concerning lines and planes in space. Applying knowledge and understanding: The student will be able to use the theoretical methods and tools introduced during the course to solve problems such as knowing how to calculate the rank of a matrix, knowing how to study a vector space, knowing how to study a linear application, knowing how to determine the eigenvalues and eigenvectors of an endomorphism, knowing the diagonalization of a matrix, being able to solve linear geometry problems concerning points, lines and planes in space. Making judgments The student will be stimulated to independently carry out exercises on the topics covered in order to critically monitor their own learning process. They will be able to autonomously develop solutions to the main problems covered by the course; they will choose the most effective strategy based on the learned results. Constructive discussion with other students and with the teacher will be encouraged. Communication skills: The student will acquire the rigor of the mathematical language and the specific language of geometry through the attendance of the lessons and the study of the recommended teaching material. They will learn to communicate the acquired knowledge with rigor and clarity, both in oral and written form. At the end of the course the student will be aware that the mathematical language is fundamental to communicate clearly in the scientific field. Learning skills: The aim of the course is to provide the student with a study method and the logical rigor that will be necessary for him to continue his engineering studies. In particular, they will be able to use the methods learned by applying them to new topics.
ASSESSMENT METHODS	The exam consists of an obligatory written test (lasting 75 minutes) and an optional oral test. Written test: Three open-ended questions will be proposed. Excellent: 30 - 30 with honors Excellent knowledge of the topics, excellent analytical skills, the student is able to apply the knowledge to solve the proposed problems. Grade: Very good. Rating: 26-29. Good grasp of the topics. Sound language skills. The student is able to use the knowledge he/she has acquired to solve problems. Grade: Good. Rating: 24-25. Basic knowledge of the main topics. Fair language skills with limited ability to independently use the knowledge acquired to solve problems. Grade: Satisfactory 21-23. The student lacks a firm grasp but has some knowledge of the main topics. Satisfactory language skills. Low ability to independently use the knowledge acquired.. Grade: Sufficient 18-20.Minimum basic knowledge of the main topics and technical language. Very low ability to independently use the knowledge acquired. Fail: The student does not have an acceptable knowledge of the topics The possible oral exam will focus on the definitions given during the course, on the proof of the main theorems and on the significant examples studied. After the oral exam a new evaluation will be given following again the above criteria.
EDUCATIONAL OBJECTIVES	Knowing the basics of linear algebra and its applications to geometry. Knowing the demonstrations of the main theorems. Knowing how to define a vector space through a base. Determine the linear dependence of a vector system by determining the rank. Knowing how to define a linear transformation through the matrix calculus.

	Knowing how to establish the structure of a linear system and put in relation with the whole of the geometric structure of the solutions. Knowing how to determine the eigenvalues and the corresponding eigenspaces of an endomorphism. Knowing how to determine a geometric entity subject to conditions. Knowing how to study the mutual position of two affine subspaces. Knowing how to properly set up a hypothetical-deductive argument.
TEACHING METHODS	The course is organized in frontal lessons and exercises. During the frontal lessons the contents of the course will be rigorously presented and analyzed together with meaningful examples, applications and exercises. The student will be invited to autonomously solve selected exercises.
SUGGESTED BIBLIOGRAPHY	Appunti e slides del corso del docente (Professor's notes and slides) Serge Lang, "Algebra Lineare", Bollati Boringhieri, 2014; ISBN 978-8833958699

SYLLABUS

Hrs	Frontal teaching
4	Numerical fields. Vector algebra: free vectors, operations with vectors, size and bases. Scalar product, vector product, vector norm, versors.
4	Vector spaces, generators, linearly independent vectors. Dimension and basis of a vector space.
4	Matrices, row-reduction, rank and determinant.
4	Matrices, rank and determinant. Resolution of linear systems. Rouché-Capelli e Cramer theorems.
4	Study of lines and planes in the space.
4	Linear maps and their study.
4	Eigenvalues and eigenvectors.
2	Matrix similarity. Diagonalizable matrices.

Hrs	Practice
3	Matrix operations: sum, linear combinations, row-by-column product
3	Vector algebra. Matrix operations: row reduction, rank, determinant, inverse
3	Study of linear systems by applying the Theorem of Rouché-Capelli e Cramer.
3	Linear geometry in the plane and in the space.
3	Linear functions theory. Image and Kernel subspaces.
3	Linear functions theory. Matrix representation of a linear map.
3	Eigenvalues and eigenvectors.
3	Study of endomorphisms. Matrix similarity. Diagonalizable matrices.