UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2017/2018
BACHELOR'S DEGREE (BSC)	MATHEMATICS
INTEGRATED COURSE	GEOMETRY 1 - INTEGRATED COURSE
CODE	03678
MODULES	Yes
NUMBER OF MODULES	2
SCIENTIFIC SECTOR(S)	MAT/03
HEAD PROFESSOR(S)	VACCARO MARIA ALESSANDRA — Professore Associato — Univ. di PALERMO
OTHER PROFESSOR(S)	VACCARO MARIA ALESSANDRA — Professore Associato — Univ. di PALERMO DI BARTOLO ALFONSO — Ricercatore — Univ. di PALERMO
CREDITS	12
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	Annual
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**DI BARTOLO ALFONSO** Thursday 15:00 17:00 Studio n. 107, sito al primo piano del Dipartimento di Matematica e Informatica, via Archirafi n. 34, Palermo. **VACCARO MARIA ALESSANDRA** Wednesday 15:00 17:00 Studio n. 205, sito al secondo piano del Dipartimento di Matematica e Informatica, via Archirafi n. 34, Palermo.

DOCENTE: Prof.ssa MARIA ALESSANDRA VACCARO

PREREQUISITES	The course has no prerequisites, except for the basic notions in Mathematics from high school.
LEARNING OUTCOMES	At the end of the course the student is expected to: have acquired the fundamental concepts of linear algebra and affine and euclidean geometry (Knowledge and understanding); be able to apply the notions and the techniques learnt in the course both to standard exercises and to new problems, which require the autonomous elaboration of a strategy, or of a small rigorous proofs, not identical to the ones seen at the lectures but similar (Applying knowledge and understanding); be able to evaluate the difficulty of a problem, choosing the simplest strategies to face and solve the typical problems of linear algebra and geometry (Making judgements); be able to communicate and express problems pertaining to the topics of the course: to be able to state and prove theorems, but also to discuss problems concerning the statement of a theorem and its applications (Communication skills); have learned the interactions between the acquired methods in the course and the mathematical models that occur in other courses (Learning skills).
ASSESSMENT METHODS	The exam consists in two written examinations and an oral examination. Each written test consists in three exercises to be solved in order to ascertain abilities, skills and competencies required and usually last 3 hours. The oral examination consists of an interview to estimate the knowledge and disciplinary competencies and if the student owns autonomy of judgments and suitable communication and learning skills. During the oral examination the student should correctly answer to questions on the theory and the proofs treated in the course, and includes a discussion of the written test. Both the written tests and the oral examination are part of the final evaluation, which will be formulated out of 30. It corresponds about the following results: excellent (30 - 30 e lode): optimal knowledge of the contents of the course, optimal property of language, very good analytic abilities and competence in problem solving; very good (27 - 29): very good mastery of the contents of the course, very good property of language, good competence in problem-solving; good (24 - 26): knowledge of base treated contents, discrete property of language, with acceptable ability to independently apply the competence to solve the proposed problems; acceptable (21- 23): not have full mastery of the main contents of the course but possesses knowledge, satisfactory property of language, exiguous ability to independently apply the acquired knowledge; passing (18 - 20): minimal base knowledge of the contents of the course and of the technical language, minimal ability to independently apply the acquired knowledge; no sufficient: does not possess an acceptable knowledge of the contents of the presented topics.
TEACHING METHODS	The course is year-long and consists of 120 hours (12 CFU) of classroom teaching, half for each term, articulated in lectures and exercise sessions. At the end of each teaching module there will be a written test whose positive outcome contributes to the final evaluation.

MODULE AFFINE AND EUCLIDEAN GEOMETRY *Prof. ALFONSO DI BARTOLO*	
SUGGESTED BIBLIOGRAPHY	
Testi di riferimento: E. Sernesi, Geometria 1, Bollati Boringhieri M. Abate, Geometria, Mc Graw-Hill Testi di consultazione: E. Schlesinger, Algebra Lineare e Geometria, Zanichelli M. Rosati, Lezioni di Geometria, Edizioni Libreria Cortina Padova	
AMBIT	50197-Formazione Matematica di base
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60
EDUCATIONAL OBJECTIVES OF THE MODULE	
The main aim of this course is to give students a thorough introduction to the bilinear forms, sesquilinear forms on a complex vector space and analytic geometry in affine and Euclidean spaces. The course also aims at giving the student a firm understanding of analytic method in the visualization of mathematical concepts and it develops the student's skills to solve problems using the analytic method. Upon completion of the course a student will be able to: classify symmetric bilinear forms on a real vector space and hermitian sesquilinear forms on a complex vector space; - define affine space and introduce affine coordinate system; - determine the mutual position of two affine subspaces; - define Euclidean space and introduce Cartesian coordinate system as the specialization of affine coordinate system; - determine equations of orthogonal subspaces, compute distances and angles of Euclidean subspaces, especially in dimensione 2 and 3; - define circle, sphere, cone, cylinder and determine their equation.	

SYLLABUS

Hrs	Frontal teaching
8	Symmetrical, alternating and antisymmetrical bilinear forms. Canonical form for alternating forms. Canonical form for symmetrical bilinear form over an algebraically closed field. Sylvester's theorem. Spectral Theorem. Hermitian Sesquilinear Forms. Sylvester's theorem and spectral theorem for Hermitian shapes
8	Affine spaces. Coordinate system on an affine space. Affine subspaces. Parametric and Cartesian equations of an affine subspace. Intersection and sum of affine subspaces. Affine subspace generated by a finet set. Relative position of two affine subspaces.
6	Euclidean affine spaces. Distance between a point and a line. Distance between a point and a plane. Distance between two skew lines.
4	Plane isometries.
6	Circle. Sphere. Cone. Cylinder.

Hrs	Practice
8	Canonical form for symmetrical bilinear forms. Sylvester's theorem. Spectral Theorem.
8	Coordinate system on an affine space. Affine subspaces. Parametric and Cartesian equations of an affine subspace. Intersection and sum of affine subspaces. Affine subspace generated by a finet set. Relative position of two affine subspaces.
5	Distance between a point and a line. Distance between a point and a plane. Distance between two skew lines.
2	Plane isometries
5	Circle. Sphere. Cone. Cylinder.

MODULE LINEAR ALGEBRA *Prof.ssa MARIA ALESSANDRA VACCARO*	
SUGGESTED BIBLIOGRAPHY	
Testi di riferimento (Textbooks): M. Abate, Algebra Lineare, Mc Graw-Hill G. Vaccaro, A. Carfagna, L. Piccolella, Lezioni di geometria e algebra lineare, Zanichelli Testi di consultazione (Reference books): A. Carfagna, L. Piccolella, Complementi ed esercizi di geometria e algebra lineare, Zanichelli C. Ciliberto, Algebra Lineare, Bollati Boringhieri L. Mauri, E. Schlesinger, Esercizi di algebra lineare e geometria, Zanichelli E. Schlesinger, Algebra lineare e geometria, Zanichelli E. Sernesi, Geometria 1, Bollati Boringhieri	
AMBIT	50197-Formazione Matematica di base
INDIVIDUAL STUDY (Hrs)	90
COURSE ACTIVITY (Hrs)	60
EDUCATIONAL OBJECTIVES OF THE MODULE	
The aim of the course is to furnish the students with the basic notions of linear algebra, which will be used in Affine and Euclidean Geometry course and in most of the following studies. The theoretical structure of the course is the development of the topics of the program, through the introduction of fundamental concepts and the development of a series of theorems and proofs, supported by meaningful examples, exercises and applications. In particular, the course has: 1) theoretical aims: development of a rigorous mathematical language; acquisition of abstract concepts, algebraic structures, theorems and proofs, pertaining to linear algebra and geometry; 2) applied aims: acquistion of calculus techniques; problem solving skills both in standard exercises and in new problems, where it is necessary to elaborate autonomously a strategy and apply the notions of the course, or to elaborate a small proof similar to the ones seen at the lectures.	

SYLLABUS

Hrs	Frontal teaching
7	Vector spaces over a field: definition, linear subspaces. Sum and intersection of linear subspaces. Generators, linear dependence and independence, basis and dimensions of finitely generated vector spaces. Grassmann formula; direct sum of subspaces.
6	Matrices: trace, rank and operations with matrices. Determinant, minors, Laplace’s rule.
3	Linear systems: resolution with the Gauss reduction method.Theorem of Rouché-Capelli and theorem of Cramer.
6	Linear maps, matrices associated to linear maps. Kernel and image of a linear map. Endomorphisms and isomorphisms of linear spaces. Relation between the rank and the dimension of the kernel.
6	Eigenvalues, eigenvectors and eigenspaces of an endomorphism. Characteristic polynomial, direct sum of eigenspaces. Diagonalizable endomorphisms and matrices. Diagonalization criteria.
4	Jordan canonical form.

Hrs	Practice
6	Vector spaces over a field.
4	Matrices, rank and determinant.
4	Linear systems.
4	Linear maps.
6	Eigenvalues, eigenvectors and eigenspaces of an endomorphism.
4	Jordan canonical form.