Anna Tozzi

Programme of "Istituzioni di Geometria Superiore I" ***"Foundations of Higher Geometry I" - Introduction to Algebraic Topology***		
Number of ECTS credits: 9 (workload is 225 hours; 1 credit = 25 hours)		
F1195, Compulsory **1st Cycle in MATHEMATICS, 3rd year , 2nd semester** Teacher: **Anna Tozzi**		
1	**Course objectives and Learning outcomes**	The goal of this course is to provide the motivations, definitions and techniques for the translation of topological problems into algebraic ones, hopefully easier to deal with. On successful completion of this module, the student should understand the fundamental concepts of algebraic geometry and should be aware of potential applications of algebraic topological invariants in other fields as theoretical physics , including the computational fluid mechanics and electrodynamics.
2	**Dublin descriptors**	Topics of the module include: **General Topology:** Topological spaces and continuous maps, induced, quotient and product topology, Metric spaces, Hausdorff spaces, Compact spaces, connected spaces, Paths and path connected spaces. **Manifolds and surfaces:** The pancake problems, n-dimensional manifolds, surfaces and classification of surfaces. **Homotopy:** Retracts and contractible spaces, paths and multiplication, the fundamental group, the fundamental group of the circle. **Covering spaces:** The fundamental group of a covering space, the fundamental group of a orbit space, lifting theory and existence theorems, the Borsuk-Ulam theorem, the Seifert-Van Kampen theorem, the fundamental group of a surface **Introduction to singular homology :** standard and simplicial simplexes. On successful completion of this module, the student should - have profound **knowledge** of basic techniques in Homotopy Theory, - have **knowledge and understanding** of geometric and topological arguments, - **understand and explain** the meaning of complex statements using mathematical notation and language; - **understand** the fundamental concepts of Topology, algebra and their connections and be aware of potential applications in other fields, - **demonstrate skill** in mathematical reasoning and **ability** to conceive a proof, - demonstrate **capacity** for reading and understand other texts on related topics.
3	**Prerequisites and learning activities**	The student must know the basic notions of General Topology and Geometry contained in the exams Geometry A, B and Algebra
4	**Teaching methods and language**	Lectures and exercises. Language: Italian / English **Ref. Text books** Czes Kosniowski, ***A first course in algebraic topology***, Cambridge University Press, 1980 Italian translation: ***Introduzione alla Topologia Algebrica***, Zanichelli Ed. 2010
5	**Assessment methods**	Written and oral exam.

Programme of "Matematica Discreta II" **"Discrete Mathematics II":** **This course is composed of two Modules: 1) Logic, 2) Geometry**		
Number of ECTS credits: 6 (workload is 150 hours; 1 credit = 25 hours)		
F0123, Compulsory **1st Cycle in COMPUTER SCIENCE, 1st year , 2nd semester**		
1) LOGIC		
Teacher: **Anna Tozzi**		
1	**Course objectives and Learning outcomes**	The goal of this course is to provide the motivations, definitions and techniques in support of the usefulness of logic in the effective and efficient modeling of data and knowledge. This Module is an introduction to mathematical logic and covers elementary discrete mathematics for computer science. On successful completion of this module, the student should understand the fundamental concepts of mathematical logic and should be aware of potential applications in computing, including the limitations of algorithms.
2	**Dublin descriptors**	Topics of the module include: **Propositional Logic:** Logical formulae, valuations, truth tables, logical equivalence of formulae, satisfaction and logical implication. **Deductive Logic:** Formal axiom schemes, the structure of formal proofs, Sequent Calculus, Natural Deduction, the Deduction Theorem, and connections between truth and proof (the **Soundness and Completeness Theorems**). On successful completion of this module, the student should - have profound **knowledge** of basic techniques in set theory, - have **knowledge and understanding** of logical and deductive arguments - **understand and explain** the meaning of complex statements using mathematical notation and language; - **understand** the fundamental concepts of mathematical logic and should be aware of potential applications in computing. - **demonstrate skill** in mathematical reasoning, manipulation and calculation; - demonstrate **capacity** for finding rigorous proofs of small problems;
3	**Prerequisites and learning activities**	The student must have the basic mathematical notions and methods as acquired in the secondary Schools
4	**Teaching methods and language**	Lectures and exercises. Language: Italian **Ref. Text books** A. Asperti – A. Ciabattoni, ***Logica a informatica***, McGraw Hill, 1997
5	**Assessment methods**	Written and oral exam.
2) GEOMETRY		
Teacher: **Anna Tozzi**		
1	**Course objectives and**	The goals of this course are to introduce students to the terminology and theorems

	Learning outcomes	of plane and solid geometry, and to apply algebraic, spatial, and logical reasoning to solve geometry problems. This Module covers the fundamental concepts of Linear Algebra and its role in describing geometric settings. On successful completion of this module, the student will develop spatial sense, visualize and represent geometric figures , explore transformations of geometric figures, understand and apply geometric properties and relationships, synthesize geometric concepts into algebraic, functional, and problem-solving activities.
2	**Dublin descriptors**	Topics of the module include: **Geometry:** Euclidean plane geometry, angles, radians, notion of geometric place, properties of triangles, parallelograms, circles, symmetry and similarity, transformations in the plane, Cartesian coordinates and equations of simple geometric places, elements of trigonometry, elements of spatial Euclidean geometry, volumes. On successful completion of this module, the student should - have profound **knowledge** of basic techniques in Linear Algebra; - have **knowledge and understanding** of geometric relationships within the axiomatic structure of Euclidean geometry; - **understand and explain** the relation of geometry to algebra and trigonometry by using the Cartesian coordinate and **recognize** geometric relationships in the world; - **understand and apply** geometric properties and relationships; - **demonstrate skill** in mathematical reasoning, manipulation and calculation by synthesizing geometric concepts into algebraic, functional, and problem-solving activities; - **demonstrate capacity** to deduce properties of, and relationships between, figures from given assumptions and from using transformations.
3	**Prerequisites and learning activities**	**Prerequisites: Set Theory** (language of set theory, the notion of function, graphs of fundamental functions, concept of sufficient and necessary condition**), Numerical Structures** (natural numbers, prime numbers, numerical fractions, rational numbers, basics of real numbers, inequalities, absolute value, powers and roots); **Elementary algebra** (polynomials and operations on polynomials, identity, first- and second-degree equations); **Algebraic Structures** (Groups, homeomorphisms, rings); **Linear Algebra:** Linear systems, matrices, matrix operations, vectors and vector spaces, elementary operations on vectors, linear independence, bases, rank of a matrix linear transformations, determinants, inner product spaces, eigenvalues, and eigenvectors.
4	**Teaching methods and language**	Lectures and exercises. Language: Italian **Ref. Text books** - Paola Favro e Andreana Zucco, ***Appunti di Geometria Analitica***. Quaderni Didattici del Dipartimento di Matematica-Università di Torino, 2004. -**Notes**
5	**Assessment methods**	Written and oral exam.