UNIVERSITÀ DI PISA

GEOMETRY

BRUNO MARTELLI

Anno accademico	2022/23
CdS	MATHEMATICS
Codice	768AA
CFU	11

Moduli	Settore/i	Tipo	Ore	Docente/i
ISTITUZIONI DI GEOMETRIA	MAT/03	LEZIONI	72	BRUNO MARTELLI

Learning outcomes

Knowledge
The aim of the course is to provide the students with a solid knowledge of the most important differential geometric tools, with an eye towards their use in all areas of Mathematics, as well as in the application of Mathematics to other fields. In particular, the student who successfully completes the course will acquire a solid knowledge of: - smooth manifolds; - vector bundles, vector fields and flows; - basic Riemannian geometry; - differential forms and de Rham cohomology.

Assessment criteria of knowledge
The exam consists in a written and an oral part. Many home exercises will be assigned to the students who attend the lessons weekly, to help them following the lectures.

Skills
To understand and manipulate smooth manifolds, vector fields and bundles, De Rham cohomology, and some Riemannian geometry.

Assessment criteria of skills
The exam consists in a written and an oral part. Many home exercises will be assigned to students attending the lessons weekly, to help them following the lectures.

Behaviors
The student must learn independently and solve hard exercises.

Assessment criteria of behaviors
The exam consists in a written and an oral part. Many home exercises will be assigned to attending students weekly, to help them following the lectures.

Prerequisites
The first two years of mathematics. It would be advisable to have already followed Geometria e Topologia Differenziale.

Teaching methods
Lessons will be face to face.
Home exercises will be assigned to attending students every week.

Syllabus
The course covers the basics of differential geometry: smooth manifolds, smooth maps, partitions of unity, tangent vectors, vector bundles, tangent and cotangent bundles, tensor bundles, sections of vector bundles, vector fields and differential forms, the flow of a vector field, Lie brackets, orientation, tubular neighbourhoods, Whitney's immersion theorems, foliations, transversality, Lie groups.
The second part of the course covers differential forms and De Rham cohomology: integration and external differentiation of differential forms, orientation, Stokes theorem, Mayer-Vietoris sequence, Poincare' lemma, cohomology of euclidean spaces and spheres, Poincare' duality, Kunneth theorem.

The last part covers the basics of Riemannian geometry: connections, covariant derivative, parallel transport, Riemannian metrics, isometries,

Levi-Civita connection, geodesics, exponential maps, Riemannian distance, minimizing properties of geodesics, the Riemann and Ricci tensors, sectional curvature.

Bibliography
A book project freely available from the course web page will cover all the topics mentioned during the lectures.

Non-attending students info
Study the whole program on the curse notes, looking at the website. The exam will be written and oral.

Assessment methods
Written and oral exams. Some home exercises will be assigned on a weely base.

Class web page
http://people.dm.unipi.it/martelli/didattica.html

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