Stampare su carta intestata del CdS

General information		
Academic subject	**ELEMENTS OF ADVANCED GEOMETRY 2**	
Degree course	LM-40 - Mathematics	
Academic Year	*I year*	
European Credit Transfer and Accumulation System (ECTS)	7	
Language	*Italian*	
Academic calendar (starting and ending date)	*II semester*	
Attendance	*No (but recommended)*	

Professor/ Lecturer	
Name and Surname	Francesco Bastianelli
E-mail	francesco.bastianelli @uniba.it
Telephone	080 5442664
Department and address	*Department of Mathematics*
Virtual headquarters	
Tutoring (time and day)	Monday 5.00-7.00 PM. In order to schedule an appointment, please contact the teacher by e-mail.

Syllabus	
Learning Objectives	Mathematical knowledge which is usually learned during the first two years of a degree of L–35 class. In particular, classical analysis of one and several variables, linear algebra, affine and projective geometry, general topology. Basic theory of differentiable manifolds, which is usually learned during the third year of a degree of L–35 class. In particular, notion of differentiable manifold, tangent and cotangent space to a differentiable manifold at a point, differential forms on a differentiable manifold.
Course prerequisites	Mathematical knowledge which is usually acquired during the first two years of a degree of L-35; in particular: linear algebra, affine geometry, projective geometry, topology.

Stampare su carta intestata del CdS

Contents	**1. Elements of category theory:** categories, isomorphisms, functors. **2. Fundamental group and covering spaces:** homotopy, fundamental group, functorial properties of the fundamental group, covering spaces, liftings, theorem of Seifert–Van Kampen, applications. **3. Complexes, homology and cohomology:** exact sequences of abelian groups, chain complexes, morphisms of complexes, homology groups, exact sequences of complexes, induced long exact sequence of homology groups, homotopy of complexes, dual complexes and cohomology. **4. De Rham cohomology:** cochain complexes, cohomology groups, the de Rham complex and its cohomology, Poincaré lemma. **5. Singular homology and singular cohomology:** singular simplexes and singular chains, singular homology, singular cohomology, the Mayer–Vietoris sequence and applications, Stokes theorem. **6. Elements of sheaves theory:** presheaves and sheaves of abelian groups, morphism of presheaves, stalk of a presheaf, sheaf associated to a presheaf, exact sequences of sheaves. **7. Cohomology of sheaves:** resolutions of sheaves, soft sheaves and canonical resolutions, cohomology groups of a sheaf, acyclic sheaves, de Rham theorem.
Books and bibliography	M. ABATE, F. TOVENA, *Geometria differenziale*, Springer. W. FULTON, *Algebraic topology*, Springer. C. KOSNIOWSKI, *A first course in algebraic topology*, Cambridge University Press. M. MANETTI, *Topologia*, Springer. I. MADSEN, J. TORNEHAVE, *From calculus to cohomology*, Cambridge University Press. E. SERNESI, *Geometria 2*, Bollati Boringhieri. R. O. WELLS, *Differential analysis on complex manifolds*, Springer.

Stampare su carta intestata del CdS

Additional materials	*Futher information will be available:* *https://sites.google.com/site/francescobastianelli/teaching*

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
175	*48*	24	*103*
ECTS			
7	7	1	
Teaching strategy			
	Lectures and exercise classes.		
Expected learning outcomes			
Knowledge and understanding on:	Assimilating fundamental concepts in modern geometry and of elementary algebraic topology. Assimilating the related techniques.		
Applying knowledge and understanding on:	The assimilated theoretical knowledge is involved in large part of geometry and its applications.		
Soft skills	• *Making informed judgments and choices* Ability to analyze the consistency of the logical arguments appearing in a proof. • *Communicating knowledge and understanding* Students should learn the mathematical language and formalism necessary to read and comprehend textbooks, to explain the assimilated knowledge, and to describe, analyze and solve problems. • *Capacities to continue learning* Assimilate suitable learning methods, supported by consulting textbooks and by solving the exercises and questions which are periodically proposed during the course.		

Assessment and feedback	

Methods of assessment	Oral exam about the topic of the course, to evaluate the understanding of the themes investigated.
Evaluation criteria	• *Knowledge and understanding* ○ Quality and accuracy of the techniques, of the proofs, and of the abstract reasoning based on the topic of the course. • *Applying knowledge and understanding* ○ Ability of apply the techniques and the notions presented in the course in order to solve concrete geometric problems. • *Autonomy of judgment* ○ Ability of deciding the accuracy of a formal reasoning and ability of choosing suitable techniques for solving a problem. • *Communicating knowledge and understanding* ○ Quality and accuracy of the acquired knowledge and of the reasoning skills. • *Communication skills* ○ Property and accuracy of the exposition
Criteria for assessment and attribution of the final mark	The final assessment is given in the range 18/30 e lode. The exam is passed if the assessment is greater or equal to 18. It depends on the quality, the accuracy and the precision showed during the exam, concerning the acquired knowledge and ability.
Additional information	