Università degli Studi di L'Aquila - Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica

Course catalogue

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Programme of Integrated course "Advanced Geometry "

This course is composed of 2 Modules: 1) Advanced Geometry 1, 2) Advanced Geometry 2

Programme of Module "Advanced Geometry 1"

- Code: DT0118
- Type of course unit: Compulsory (Master Degree in Mathematics curriculum Generale)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Mathematics) 6 (workload 150 hours)

Teachers: Lucio Bedulli

1	**Course objectives**	
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • DIFFERENTIABLE VARIETIES. Definitions. Examples of differentiable varieties. Differentiable functions. Differentiable maps. Tangent space. Cotangent Space. More examples of differentiable varieties. Subvarieties. Paracompactness and partition of unity. Whitney's Theorem. • GROUP ACTIONS. Topological groups and Lie groups. Homomorphisms of Lie groups. Groups actions. The action of a discrete group on a variety. Homogeneous Spaces. Examples of homogeneous spaces. Connected Lie groups. Grassmann variety. Flag variety. • DE RHAM COHOMOLOGY. Multilinear Algebra recalls. Tangent and cotangent bundles. Differential forms. De Rham cohomology. Poincaré's Lemma. Hypersurfaces and fields of normal vectors. Orientable manifolds. Mayer-Vietoris' sequence and its application in computing De Rham cohomology.
3	**Course prerequisites**	
4	**Teaching methodsand language**	**Language**: English
5	**Assessment methods**	

Programme of Module "Advanced Geometry 2"

- Code: DT0119
- Type of course unit: Compulsory (Master Degree in Mathematics curriculum Generale)
- Level of course unit: Postgraduate Degrees
- Semester: 2

Number of ects credits: (Master Degree in Mathematics) 6 (workload 150 hours)

Teachers: Lucio Bedulli

1	**Course objectives**	-The goal is to acquire a good knowledge of basic concepts about topological manifolds, CW-complexes and simplicial complexes (Fedeli). - The student should learn the basic notions of the theory of Riemann surfaces necessary to establish some theorem and to solve problems about this subject (Nelli)
2	**Course content and learning outcomes (dublin descriptors)**	Topics of the module include: • Smooth manifolds with boundary and Stokes' theorem • de Rham Theorem • Hodge theory • Vector bundles • Introduction to Riemannian Geometry On successful completion of this module, the student should : • The student should learn the basic notions of Riemann surfaces theory.

		The student should have a basic knowledge on topological manifolds and complexes. • The student should be able to solve small problems about the theory Riemann surfaces, using notions and theorems of the course. The student should be able to use the acquired tools. • The student should understand how to apply the acquired notions of Riemann Surfaces theory to the proposed problems. The student should be able to understand and solve problems. • The student should be able to explain the statements and the proofs of the theorems about Riemann surfaces. The student should be able to present in a clear and rigorous way the acquired knowledge. • The student should have acquired the ability of reading and understanding more advanced result about Riemann surfaces. The student should develop those learning skills necessary to deal with the subsequent studies.
3	**Course prerequisites**	An introductory course on algebraic topology (fundamental group and singular homology) Basics on smooth manifolds (in particular differential forms and de Rham cohomology).
4	**Teaching methodsand language**	Lectures **Language**: English
5	**Assessment methods**	Oral exam