

**Homology and Cohomology (Omologia e Coomologia)**  
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Faculty of di Mathematics, Physics and Natural Sciences  
Mathematics Second Level Course

It is open to students of the **Master's degree in Mathematics (Laurea Specialistica)**, and to students of the **Master Mundus ALGANT** program.

**When:** second trimester

**Where:** Department of Pure and Applied Maths, Padova.

**Total number of hours:** about 48 (6 credits).

**Examination:** oral exam.

### **Prerequisites**

Basic algebra and topology.

### **Program**

We introduce for general topological spaces some invariants groups (homology groups) which give informations on the geometry of such a topological spaces (Betti numbers, fundamental groups). This will be done using singular, simplicial and CW homology theories. We will give some examples and applications of such a formalism. We will introduce also the dual theory called cohomology theory which admits some important operations. We will specialize such a constructions to topological spaces which are manifolds (i.e. with a differentiable structure) and interpretate the cohomology groups in terms of differential forms. We will, finally, try to show how the formalism we have introduced can be imitated in others fields: as for algebraic varieties (via sheaf theory) or for group theory.

### **References**

- 1) J.J. Rotman *An introduction to algebraic geometry*, Springer Verlag GTM 119 (1988).
- 2) W.S. Massey *Singular homology theory*, Springer Verlag 1980.
- 3) Lecture notes.