Algebraic Geometry 1 (Geometria Algebrica 1)

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Mathematics Second Level Course

The course 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 Mathematics, Padova
Total number of hours: 64 (8 credits)
Examination: oral

Description of the course

In this course we shall review the classical notions of affine and projective varieties, and study their basic properties. We shall define morphisms between algebraic varieties, regular functions, rational and birational maps, etc. The relations between birational maps and blow-ups will also be analysed. A good knowledge of these classical notions will be extremely important in order to fully appreciate the power and generality of the theory of schemes. However, before we can even define what a scheme is, we shall develop a little bit of sheaf theory; after that we shall define affine schemes and explain how to glue them together to obtain the general notion of scheme. Finally, we shall study the first basic properties of schemes and morphisms of schemes.

Prerequisites: some basic commutative algebra (at the level of the first chapters of Atiyah-Macdonald's *Introduction to Commutative Algebra*).

Program

1. Affine and projective varieties
2. Regular and rational functions, morphisms
3. Local properties: singular and nonsingular points
4. Birational maps, blow-up
5. Sheaves and morphisms of sheaves
6. Schemes and morphisms of schemes
7. First properties of schemes and morphisms of schemes

References

1. R. Hartshorne: *Algebraic Geometry*, Springer-Verlag, 1977.
2. I.R. Shafarevich: *Basic Algebraic Geometry, vols. 1 and 2*, Springer-Verlag, 1994.
3. Q. Liu: *Algebraic Geometry and Arithmetic Curves*, Springer-Verlag, 1994.