SCHEME THEORY
(ECTS) 7.5 COURSE CREDITS

1. Course Description

The aim of this course is to give an introduction to modern Algebraic Geometry via the language of Scheme Theory. This theory was developed by Alexander Grothendieck and the French School in the sixties and has soon been regarded as the proper framework to study geometric objects both form the geometric and the arithmetic point of view. Nowadays schemes are ubiquitous in papers in Algebraic and Arithmetic Geometry. They are also used to solve problems in Kähler Geometry and Hodge Theory in Complex Analysis, in Algebraic Topology (J. Lurie) and in Langlands Theory (P. Scholze). The ideas of Grothendieck have even had applications to Mirror Symmetry (Kontsevich) and other areas of Mathematical Physics.

The course will be mainly concerned with definitions and basic properties of affine and projective schemes, divisors and linear systems. In particular the focus will be on Chapter 2 of Hartshorne's book *Algebraic Geometry* and on some applications to the study of algebraic curves (Chapter 4).

2. Aim of the course

At the end of the course the students should be able to understand and use basic techniques of the theory of Schemes for study more advanced topics and applications.

3. Duration

The course will either span over LP3 meeting twice a week or over both LP3 and LP4 meeting once week, depending on participants.

4. Prerequisites

Basic knowledge of commutative algebra. Some knowledge of basic algebraic geometry and/or differential geometry will be useful but not necessary. Notions from sheaves and category theory will be given in the beginning of the course.

5. Lecturers and Course organizer

- Per Salberger, salberg@chalmers.se (Course organizer/lecturer)
- Amos Turchet, tamos@chalmers.se (Lecturer)
- Dennis Eriksson, dener@chalmers.se (Lecturer)

6. LECTURES AND EXAMINATION

One or two two-hour lectures every week during the beginning of 2015, starting in mid-January. At the end of the course there will be an oral exam.

7. LITERATURE

Main textbook:

- Hartshorne, Robin: *Algebraic geometry*, Graduate Texts in Mathematics, No. 52, Springer-Verlag (1977).

Suggested reading:

- Eisenbud, David and Harris, Joe: *The geometry of schemes*, Graduate Texts in Mathematics, No. 197, Springer-Verlag (2000);

- Vakil, Ravi: *Foundation of Algebraic geometry*, notes of a forthcoming book, available online at `http://math.stanford.edu/~vakil/216blog/`;

- Liu, Qing: *Algebraic geometry and arithmetic curves*, Oxford Graduate Texts in Mathematics, Oxford University Press (2002);

- Görtz, Ulrich and Wedhorn, Torsten: *Algebraic geometry I*, Advanced Lectures in Mathematics, Vieweg + Teubner, Wiesbaden (2010).

8. REGISTRATION

Please email the course organizer for registration.