The Department of Mathematics  
2020–21–A term

Course Name  Algebraic Geometry - Schemes - 1

Course Number  201.2.0121

Course web page  
https://www.math.bgu.ac.il/~amyekut/teaching/2020-21/schemes-1/course_page.html

Lecturer  Prof. Amnon Yekutieli, <amyekut@bgu.ac.il>, Office 202

Office Hours  
https://www.math.bgu.ac.il/en/teaching/hours

Abstract

Requirements and grading

See course web page for details

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1Information may change during the first two weeks of the term. Please consult the webpage for updates
Algebraic Geometry – Schemes 1

BGU, Fall 2020-21

Catalogue no. 201.2.0121

The course will be in English. It will continue in the Spring semester, as "Algebraic Geometry – Schemes 2".

Course web site (with up-to-date information):
https://www.math.bgu.ac.il/~amyekut/teaching/2020-21/schemes-1/course_page.html

Prerequisites and Level. The course is intended for graduate students and advanced undergraduate students.

Participants of the course should have – ideally – familiarity with most of these topics: categories and functors, introduction to algebraic geometry (varieties over an algebraically closed field, or at least algebraic curves); commutative algebra; homological algebra; algebraic topology; and differentiable or complex analytic manifolds.

The level of the course will be calibrated – in terms of rate of progress and sophistication of the presentation – to the audience, under the assumption that they had already learned much of the material listed above.

Please send me an email if you are considering attending the course, indicating which of the topics above you have learned (in a formal course or privately), your academic status (degree and year), and whether you intend to register or just to listen.

Course Topics :
1. **Categories and functors.** Definitions and examples. Natural transformations.
4. **Affine Schemes.** Definitions and basic properties. Morphisms. Examples from arithmetic.
6. **Maps of schemes.** Fiber products and base change. Finite, finite type, flat, separated, proper and projective maps.

7. **Maps to projective space and blow-ups.** Definitions and examples. Computing the Picard group of the projective space $\mathbb{P}^n$.

8. **Calculating some invariants.** Sheaf cohomology, genus, etc.

9. **The functor of points and moduli spaces.**

10. **Algebraic differential calculus.** Smooth morphisms, differential forms, etc.

11. **Group schemes and their Lie algebras.**

**Bibliography:**

3. Olsson, *Algebraic Spaces and Stacks*, AMS.
5. de Jong (Ed.), *The Stacks Project*, online
6. Course lecture notes (to be posted weekly).
Course topics

1. Sheaves on topological spaces
2. Affine schemes
3. Schemes and morphisms between them.
4. Quasi-coherent sheaves
5. Separated and proper morphisms.
6. Vector bundles and the Picard group of a scheme.
7. The functor of points and moduli spaces.
8. Morphisms to projective space and blow-ups.
10. Sheaf cohomology.