

MATH 7280: ALGEBRAIC GEOMETRY I

FALL 2005

1. BASIC INFORMATION

Text : Hartshorne: **Algebraic Geometry**, Springer, GTM 52.

Time/Place: MTWThF 12:40–1:30 PM, Lockett 113.

Grade: There will be homeworks collected and graded, probably 3 sets.

The students will be responsible for LaTeXing the lectures and filling in details. These will also be graded.

Syllabus:

- I. Algebraic varieties.
 1. Affine algebraic sets
 2. Noetherian rings and modules
 3. Zariski topology
 4. Nullstellensatz
 5. V-I correspondence
 6. Morphisms
 7. Examples, Singular
 8. Localization; local rings
 9. Integral extensions
 10. Proof of the NSZ
 11. Projective space, \mathbf{P}^n
 12. Projective V-I, affine cone
 13. (de)homogenization
 14. Morphisms, rational maps
 15. Birational maps, function field
 16. Blowing-up; resolution of singularities
 17. Graded modules; Hilbert polynomial
 18. Intersection theory in projective space
- II. Introduction to schemes.
 1. Sheaves, \mathcal{O}_X
 2. Sheaves II, stalks
 3. Sheaves III, étalé space
 4. Sheaves IV, direct and inverse image
 5. $\text{Spec}(R)$, \tilde{M}
 6. Affine schemes

7. Local ringed spaces, schemes
8. $\text{Proj}(S)$.
9. Elementary properties
10. Dimension theory
11. Categories and functors
12. Yoneda & representable functors
13. Adjoint functors, f_* , f^*
14. \otimes and Hom
15. Fiber-products and base-change
16. Differentials
17. (Non)singularity
18. Projective and proper morphisms
19. Divisors and line bundles

REFERENCES

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- [2] Ueno, Kenji, Algebraic Geometry I, II, III, Translations of the AMS, Iwanami Series in Modern Mathematics. American Mathematical Society, Providence, RI, 185, 197, 218.
- [3] Mumford, David, The red book of varieties and schemes. Lecture Notes in Mathematics, 1358. Springer-Verlag, Berlin, 1988.
- [4] Eisenbud, David; Harris, Joe, The geometry of schemes. Graduate Texts in Mathematics, 197. Springer-Verlag, New York, 2000.
- [5] Eisenbud, David, Commutative algebra. With a view toward algebraic geometry. Graduate Texts in Mathematics, 150. Springer-Verlag, New York, 1995.
- [6] Atiyah, M. F.; Macdonald, I. G., Introduction to commutative algebra. Addison-Wesley Publishing Co., Reading, Mass.-London-Don Mills, Ont. 1969
- [7] Reid, Miles, Undergraduate algebraic geometry. London Mathematical Society Student Texts, 12. Cambridge University Press, Cambridge, 1988.
- [8] Dieudonné, Jean, Algebraic geometry. Advances in Math. 3, 233–321 (1969) and Fondements de la géométrie algébrique moderne. Advances in Math. 3, 322–413 (1969).

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