

Math 607
Winter 2008

Seminar in
Commutative Algebra

Syllabus
Prof. M. Vitulli

Texts:

- Commutative Ring Theory by Hideyuki Matsumura, Translated by Miles Reid, Cambridge University Press, 1989.
- Integral Closure of Ideals, Rings, and Modules by I. Swanson and C. Huneke, Cambridge University Press, 2006.

[Swanson-Huneke is available online at <http://people.reed.edu/~iswanson/book/index.html>]

Additional References:

AM Atiyah, M.F. and Macdonald, I.G., Introduction to Commutative Algebra, Addison-Wesley, 1969

BH Bruns, W. and Herzog, J., Cohen-Macaulay Rings, Cambridge University Press, 1993

E Eisenbud, D., Commutative Algebra with a View Toward Algebraic Geometry, Springer-Verlag 1995

GS Geramita, A. and Small C., Introduction to Homological Methods in Commutative Algebra, Queen's Papers in Pure & Applied Mathematics, No. 43, Queen's University, 1976

Ka Kaplansky, I., Commutative Rings, Revised Edition, The University of Chicago Press, 1974

Ku Kunz, E., Introduction to Commutative Algebra and Algebraic Geometry, Birkhäuser, 1985

M Matsumura, H., Commutative Algebra, Second Edition, Benjamin/Cummings 1980
Sharp, R.Y., Steps in Commutative Algebra, Cambridge University Press, 2000

ZS1 Zariski, O. and Samuel, P. Commutative Algebra I, Corrected 2nd Printing, Graduate Texts in Mathematics, Vol. 28, Springer-Verlag, 1975

ZS2 Zariski, O. and Samuel, P. Commutative Algebra II, Corrected 2nd Printing, Graduate Texts in Mathematics, Vol. 29, Springer-Verlag, 1975

Commutative Algebra Software:

Macaulay Web Site: <http://www.math.uiuc.edu/Macaulay2/>

CoCoA Web Site: <http://cocoa.dima.unige.it/>

Singular Web Site: <http://www.singular.uni-kl.de/>

Tentative Syllabus:

Chapter 2 of SH Going down theorem, integral closure of graded rings, ring of homomorphisms of ideals

Chapter 4 of M and/or Chapter 6 of SH Valuation rings: Krull valuations, discrete (rank one) valuation rings, Dedekind domains, the Krull-Akizuki Theorem, Krull rings.

Chapter 5 of M Dimension Theory: graded rings and modules, homogeneous ideals, the Hilbert function and the Hilbert-Samuel function, systems of parameters, multiplicity, dimension of extension rings.

Chapter 1 of SH What is integral closure of ideals? Basic properties, integral closure via reductions, monomial ideals, how integral closure arises, Dedekind-Mertens formula.

Chapter 4 of SH Noetherian rings: principal ideals, normalization theorems, Jacobian ideals, Serre's conditions, affine and \mathbb{Z} -algebras, absolute integral closure, finite lying-over and height, dimension one, Krull domains.

Chapter 5 of SH Rees algebras; constructions; ;integral closure of Rees algebras, integral closure of powers of an ideal.

Chapter 6 of M Regular Sequences and Depth: regular sequences and the Koszul complex, Cohen-Macaulay rings, the Auslander-Buchsbaum dimension formula. Gorenstein rings.