

Math 216 CA

Commutative Algebra  
Course Information

Spring 2009

BLOCK: C, TWF, 9.30-10.20 AM

INSTRUCTOR: Montserrat Teixidor i Bigas

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OFFICE: Bromfield-Pearson 115

OFFICE HOURS: (Fall 2008) T, Th, F 8-8.20 a.m., T, Th 9.30-10.20 am

PHONE: 7-2358

PREREQUISITES: Math 215, 146 or consent.

TEXT: D. Eisenbud *Commutative Algebra with a view toward Algebraic Geometry*, Springer Verlag GTM 150

OTHER USEFUL BOOKS: H. Matsumura, *Commutative Algebra*, Benjamin-Cummings. M. Atiyah, I. MacDonalld *Commutative Algebra*, Addison-Wesley

COURSE DESCRIPTION: Commutative Algebra deals with the properties of commutative rings and modules over them. It was born as a useful tool to deal with problems in Number Theory but soon became an essential ingredient also in many proofs in Algebraic Geometry. These two areas provided motivation and problems for commutative algebraists who in its turn reaped their fruits. A lot of the topics that we'll cover though have applications that go far beyond these two subjects and are essential in areas like Differential Geometry, Topology and Homological Algebra. During the semester we'll have a chance to explore the origins of several problems and the applications of the various results.

We'll start with a quick review of rings and modules. We'll study localization (the equivalent of using a magnifying glass near a point or looking at only one of the prime factors of a number), primary decomposition (the equivalent of looking at how things break up into pieces in geometry or factoring a number into products of powers of primes in arithmetic) and systems of parameters (how to make things look like an  $\mathbf{R}^n$  all the time). We'll study the algebraic version of dimension and even the algebraic version of a differential!. We'll see what a tensor product is and study functors like Tor and Ext that appear all over the place in Mathematics. We'll study new topologies in which open sets are very big and learn about the famous Nullstellensatz. If time allows, we'll even learn about such classic results as resultants, syzygies ... Hopefully, we'll come out wanting to know more both of the algebra and of the applications

Homework will be assigned weekly and will be an important component of the grade. There is likely to be an in-class midterm a take home final as well as an in-class exposition of an approved topic of your choice