

MATH 435 Modern Algebra II Fall 2006

Meeting times: MWF 10:10–11:00

Prerequisites: MATH 335 (Modern Algebra) with grade C or better, or consent of the instructor

Instructor: Matthias Beck (TH 933, 415.405.3473, beck@math.sfsu.edu)

Course Objectives: Algebra studies the structure of sets with operations, such as integers with addition and multiplication, or vector spaces with linear maps. The abstract point of view, based on an axiomatic approach, reveals many deep ideas behind seemingly innocent structures—such as the arithmetic of counting numbers—and serves as an elegant organizing tool for the vast universe of modern algebra. Generations of brilliant minds have crystallized these ideas in the concept of groups, rings, fields, modules, and their quotient structures and homomorphisms—the topics of MATH 335 & 435. Our main goal in MATH 435 is the study of rings and modules, with applications in computational algebra through Gröbner bases.

Syllabus: Review of basic properties of groups and rings and their quotient structures and homomorphisms, principal ideal domains, fields of fractions, unique factorization, Euclidean domains, polynomial rings, cyclotomic polynomials, primitive roots, ideals in polynomial rings, finite fields, Berlekamp’s algorithm, term orderings, Gröbner bases, Buchberger’s algorithm, definition of modules, abelian groups as \mathbb{Z} -modules, vector spaces as F -modules, vector spaces with linear transformations as $F[x]$ -modules, submodules, module homomorphisms, quotient modules, isomorphism theorems, direct sums, free modules.

Evaluation of Students: Grades will be based on weekly homework assignments (60%), a midterm exam (20%), and a final exam (20%).

Textbook: N. Lauritzen, *Concrete Abstract Algebra*, Cambridge University Press, 2003.