

**MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS**

**ABSTRACT ALGEBRA II
MATH 372**

PREREQUISITE: Math 371 with a grade of “C” or better
TEXT: *Contemporary Abstract Algebra* – J. Gallian, 5th ed. 2002, Houghton Mifflin.
RECOMMENDED Student solution manual
SUPPLEMENT:
COVERAGE: Chapters 12 – 18, 20 – 22, and Chapters 24, 31, 32 if time permits.

COURSE OUTLINE

- 1. Chapter 12. Introduction to rings.**
 - Motivation and definition
 - Examples of rings
 - Properties of rings
 - Subrings

- 2. Chapter 13. Integral Domains**
 - Definition and examples
 - Fields
 - Characteristic of a ring

- 3. Chapter 14. Ideals and Factor Rings**
 - Definition and examples
 - Factor rings
 - Prime ideals and maximal ideals

- 4. Chapter 15. Ring homomorphisms**
 - Definition and Examples
 - Properties of ring
 - Homomorphisms
 - The field of quotients

- 5. Chapter 16. Polynomial rings**
 - Notation and Terminology
 - The Division Algorithm and consequences

- 6. Chapter 17. Factorization of polynomials**
 - Reducibility tests
 - Irreducibility tests
 - Unique Factorization in $\mathbb{Z}[x]$
 - Weird dice: An application of unique factorization

- 7. Chapter 18. Divisibility in integral domains**
 - Irreducibles, primes
 - Unique factorization domains
 - Euclidean domains

- 8. Chapter 20. Extension fields**
 - The fundamental theorem of field theory
 - Splitting Fields
 - Zeros of an irreducible polynomial

- 9. Chapter 21. Algebraic Extensions**
 - Characterization of extensions
 - Finite extensions
 - Properties of algebraic extensions

- 10. Chapter 22. Finite Fields**
 - Classification of finite fields
 - Structure of finite fields
 - Subfields of a finite field

- 11. Chapter 24*. Sylow theorems**
 - Conjugacy classes
 - The class equation
 - The probability that two elements commute
 - The Sylow theorems
 - Applications of Sylow theorems

- 12. Chapter 31*. An introduction to algebraic coding theory**
 - Motivation
 - Linear codes
 - Parity-check matrix coding
 - Coset decoding
 - Reed-Solomon Codes

- 13. Chapter 32*. An introduction to Galois Theory**
 - Galois Theory
 - Roots of Unity and Cyclotomic Polynomials
 - Solvability of Polynomials by Radicals

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