

**Southern Connecticut State University**  
**MAT 376 - Abstract Algebra II**

### **I. Catalog Description**

A continuation of the study of groups, rings and fields. Topics include quotient groups, finite abelian groups, Sylow Theorems, arithmetic of  $F[X]$ , field extensions, finite fields, elements of Galois Theory, solvability by radicals, divisibility theory.

### **II. Credit**

MAT 376 carries three (3) semester hours of college credit.  
MAT 376 is currently an elective for the B.A. in mathematics.

### **III. Prerequisite**

MAT 375

### **IV. Format**

MAT 376 is primarily a lecture-based course.

### **V. Outline**

- Review of Normal subgroups and quotient groups
- Isomorphism theorems for groups
- Review of direct sums and the Fundamental Theorem of Finite Abelian Groups
- Elementary divisors and invariant factors of a finite abelian group
- Conjugacy and the Class Equation
- The structure of finite groups of small orders
- Divisibility in polynomial rings  $F[x]$  (including the Division Algorithm, Remainder and Factor Theorems, roots and reducibility).
- Irreducibility in  $\mathbb{Q}[x]$ ,  $\mathbb{R}[x]$ ,  $\mathbb{C}[x]$
- Quick review of the basics on vector spaces
- Field extensions (including finite and algebraic extensions)
- Splitting fields
- Separability
- Finite fields
- Galois groups
- Fundamental Theorem of Galois Theory
- Solvable group and solvability by radicals
- Euclidean domains (time permitting)
- PIDs and UFDs (time permitting)
- Factorization in quadratic rings (time permitting)
- Field of quotients of an integral domain (time permitting)

### **VI. Proposed Text**

Hungerford, Thomas, Abstract Algebra, An Introduction, Third Edition, Brooks/Cole (Cengage), 2013.

Recommended coverage (excluding appropriate review): Sections 8.2-8.4, Sections 9.2-9.4, Chapters 4, 11, 12, Section 10.1-10.3 (time permitting).

## **VII. Other Recommended Texts**

Gallian, Joseph, Contemporary Abstract Algebra, Eighth Edition, Brooks/Cole, 2013.

Fraleigh, John, A First Course in Abstract Algebra, Seventh Edition, Addison-Wesley, 2003.

Rotman, Joseph, A First Course in Abstract Algebra with Applications, Eighth Edition, Prentice-Hall, 2006.

## **VIII. Outcomes**

Upon completion of MAT 376, students should be able to demonstrate satisfactory knowledge of the major concepts of abstract algebra, and they should be able to construct symbolically accurate and mathematically correct proofs of basic facts in elementary group, ring and field theory. In particular, students should:

1. Be able to demonstrate basic but solid knowledge of mathematical objects encountered during their undergraduate math career thus far (such as numbers, matrices, polynomials, functions, sets) and recognize the algebraic similarities they share.
2. Be able to prove elementary facts about rings, fields and groups by logically combining definitions and theorems.
3. Recognize when two algebraic structures (groups, rings, fields) are abstractly “the same”.
4. Acquire knowledge about the ways to obtain new algebraic structures out of old ones (e.g. sub-structures, quotient structures, field extensions, etc).
5. Understand how various group concepts intervene in the classification of groups of small orders.
6. Understand the general idea behind the insolvability of the quintic equation.

## **IX. Waiver Policy**

Course credit or waiver by examination are available for this course.

## **X. Preparers**

Alain D'Amour & Jooyoun Hong

## **XI. Prepared and Approved**

Prepared on April 5, 2016. Approved by the MDCC/Math Dept on