

Department of Mathematics
 Title of Course: Groups and Fields

Course Number: MA642
 Date: January 2011

I. **Catalog Description:** Groups, Group Actions, Sylow Theorems, Abelian Groups, Field Extensions, Galois Theory. (3)

II. **Prerequisites:** MA445 Modern Algebra

III. **Objectives of Course:**

To acquaint the students with the modern algebraic theory of groups and fields.

To acquire an appreciation for the connections between group theory and field theory through Galois theory.

IV. **Expectations of Students:**

The students are expected to participate in classroom activities, to do homework, and to be able to write proofs.

V. **Course Outline: (# class hours)**

- A. Introduction to Groups (Review) – (3)
 - 1. Basic Axioms and Examples
 - 2. Dihedral, Symmetric and Matrix Groups
 - 3. Quaternion Group
 - 4. Homomorphisms and Isomorphisms
- B. Subgroups (Review) – (3)
 - 1. Definitions and Examples
 - 2. Centralizers, Normalizers, Stabilizers and Kernels
 - 3. Cyclic Groups
- C. Quotient Groups and Homomorphisms (Mostly Review) – (6)
 - 1. Definitions
 - 2. Cosets and Lagrange's Theorem
 - 3. Isomorphism Theorems
 - 4. Composition Series
 - 5. Alternating Group
- D. Group Actions – (6)
 - 1. Permutation Representations
 - 2. Groups Acting on Themselves by Left Multiplication
 - 3. Groups Acting on Themselves by Conjugation
 - 4. Automorphisms
 - 5. Sylow Theorems
 - 6. The Simplicity of A_n
- E. Direct Products – (6)
 - 1. Definitions and Examples
 - 2. Fundamental Theorem of Finitely Generated Abelian Groups
 - 3. Groups of Small Order
 - 4. Recognizing Direct Products
 - 5. Semidirect Products
- F. Field Extensions – (8)
 - 1. Basic Theory of Field Extensions
 - 2. Algebraic Extensions
 - 3. Classical Straightedge and Compass Constructions
 - 4. Splitting Fields and Algebraic Closures
 - 5. Separable and Inseparable Extensions
- G. Galois Theory – (11)
 - 1. Basic Definitions
 - 2. Fundamental Theorem of Galois Theory
 - 3. Finite Fields
 - 4. Composite Extensions and Simple Extensions
 - 5. Galois Groups of Polynomials
 - 6. Unsolvability of the Quintic
- H. Examinations (2)

Total Class Hours: 45

VI. **Textbook:** Dummitt and Foote. *Abstract Algebra*, 3rd Edition. Wiley; 2003.

VII. Basis of Student Evaluation:

A. Assignments	60%
B. Hourly Exams	20%
C. Final Exam	20%

VIII. Grading Scale

90% - 100% = A

80% - 89% = B

70% - 79% = C

0% - 69% = F

The weight of the evaluation criteria may vary according to each instructor and will be communicated at the beginning of the course.

IX. Academic Policy Statement:

Students will be expected to abide by the University Policy for Academic Honesty regarding plagiarism and academic honesty. Refer to:

<http://www6.semo.edu/judaffairs/code.html>

X. Student with Disabilities Statement:

If a student has a special need addressed by the Americans with Disabilities Act (ADA) and requires materials in an alternative format, please notify the instructor at the beginning of the course. Reasonable efforts will be made to accommodate special needs.