

**ABSTRACT ALGEBRA I**  
**MATH 4110/8116**

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**1.0 Course Description**

- 1.1 Overview of Content and Purpose:** (3 hours) Advanced undergraduate (beginning graduate) course in abstract algebra to include congruences, axioms for number systems, group axioms, group theory, homomorphisms, isomorphisms, quotient groups, and introduction to rings, integral domains, and fields.
- 1.2 For whom Intended:** Advanced undergraduate and beginning graduate students.
- 1.3 Prerequisites:** MATH 4030/8036 or instructor's permission

**2.0 Objectives**

- 2.1 Performance Objectives for the Student:** The course attempts to develop abstract concepts by the analysis of concrete and often familiar situations. Results of classical algebra are given greater generality and unity by reinterpretation in frameworks of appropriate postulation systems.

**3.0 Content and Organization**

**3.1 Topics**

1. The Integers
  - a. Ordered integral domain
  - b. Well-ordering principle and induction
  - c. Fundamental theorem of arithmetic
  - d. Congruences
  - e. Mapping
2. Rational numbers and fields
  - a. Construction of the rationals
  - b. Ordered fields
  - c. Postulates for the positive integers
3. Polynomials
  - a. Polynomial forms and functions
  - b. Rings
  - c. Unique factorization domains
  - d. Reducibility
4. Real Numbers
  - a. Postulates of real numbers
  - b. Roots of polynomial equations
  - c. Dedekind cuts
5. Complex numbers
  - a. Construction of the complex numbers
  - b. Fundamental theorem of algebra
  - c. Conjugate polynomials
  - d. Equations of a stable type
6. Group theory
  - a. Groups of transformation
  - b. Abstract groups and isomorphisms
  - c. Subgroups and cosets
  - d. Conjugate elements
  - e. Homomorphisms and quotient groups

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**4.0 Teaching Methodology**

- 4.1 Methods to be Used:** The course is presented by lectures, supplemented by a basic text from which exercise solutions by students are selected. Most students avail themselves of individual conferences with the instructor from time to time.

**5.0 Evaluation**

- 5.1 Basis for Evaluating Student Performance:** Grades will be based on homework assignments and/or examinations. Graduate students will be assigned work not required of undergraduates.

**6.0 Resource Material**

- 6.1 Textbook(s) or Other Required Readings:**
1. Gallian, J.A., *Contempaarory Abstract Algebra*, D.C. Heath Publishing, 1986.
  2. Herstein, I.N., *Abstract Algebra*, MacMillan Publishers, 1986.
  3. McCoy, N.M., *Fundamentals of Abstract Algebra*, McGraw-Hill, 1982.
  4. Pinter, C.C., *A Book of Abstract Algebra*, McGraw-Hill, 1982.

