APPLIED MODERN ALGEBRA
MATH/CSCI 4030/8036

1.0 Course Description

1.1 Overview of Content and Purpose: (3 hours) Review of sets, relations, and functions. Semigroups, groups, rings and fields, lattices and Boolean algebra. Applications include coding theory, linear machines and finite automata.

1.2 For whom Intended:

1.3 Prerequisite: MATH 2030

2.0 Objectives

2.1 Performance Objectives for the Student: The purpose of this course is to present the traditional subject matter of modern algebra with an emphasis on applications to computer science and applied mathematics, including combinatorics. Graduate students will be expected to exhibit a deeper understanding of the material and to display this knowledge in the homework assignments.

3.0 Content and Organization

3.1 Topics:

1. Review
    a. Sets
    b. Relations
    c. Functions
2. Semigroups and Groups
    a. Algebraic Structures
    b. Monoids, semigroups
    c. Groups
    d. Elementary properties of groups
    e. Subgroups
3. Applications of group theory
    a. Error-correcting codes
    b. Group codes
    c. Graph theory
4. Rings and fields
    a. Elementary properties of rings
    b. Subrings and ideals
    c. Integral domains
    d. Euclidean domains
    e. Fields: finite fields
5. Lattices and Boolean algebras
    a. Partial order and lattices
    b. Properties of Boolean algebras
    c. Boolean functions
    d. Switching circuits
6. Applications
    a. Polynomial codes; BCH codes
    b. Linear machines
    c. Finite-state machines

4.0 Teaching Methodology

4.1 Methods to be Used: The course will be presented by lecture, class discussion and questions.

5.0 Evaluation

5.1 Basis for Evaluating Student Performance: Evaluation will be based on examination results and outside projects including homework and/or computer projects. To receive graduate credit for this course, a student must do work not required of undergraduates. To meet this requirement the graduate students will be assigned more difficult homework and/or computer projects than the undergraduate students.

6.0 Resource Material

6.1 Textbook(s) or Other Required Readings:

6.2 Current Bibliography of Resources:

1. Dornhoff, L. & Hohn, F., *Applied Modern Algebra*, MacMillan, 1978.
2. Fraleigh, J.B., *A First Course in Abstract Algebra*, Addison Wesley, 1976.
3. Gilbert, W., *Modern Algebra with Applications*, John Wiley, 1980.
4. Gill, A., *Applied Modern Algebra for the Computer Science*, Prentice-Hall, 1976.
5. Laufer, H.B., *Discrete Mathematics and Applied Modern Algebra*, Prindle, Weber, and Schmidt, Boston, MA, 19843.
6. Pinter, C.C., *A Book on Abstract Algebra*, McGraw Hill, 1982.
7. Sims, C.C., *Abstract Algebra: A Computational Approach*, John Wiley, 1984.