COURSE NUMBER/TITLE: MATH-371 (355-371) MODERN ALGEBRA II

CREDITS: 3

COURSE DESCRIPTION: Continuation of MATH-370. Rings, integral domains, fields, polynomials, vector spaces, and field extensions. Advanced topics in abstract algebra. Prerequisite: MATH-370 Modern Algebra I

TEXTBOOK: Abstract Algebra, 8th Ed., by Gallian (adopted Fall 2013)
Previous:
Abstract Algebra, 6th Ed., by Gallian (adopted 8/06)
Abstract Algebra, 5th Ed., by Gallian (adopted F03)
Modern Algebra, 8th Ed., by Gallian (adopted F00)
Abstract Algebra, 2nd Ed., by Hungerford (adopted F97)
Abstract Algebra, 1st Ed., by Hungerford Prior to S98

COURSE OBJECTIVES:
Upon successful completion of the course, the student will be able to
1. Formulate a rigorous mathematical proof.
2. Determine whether a subset of a ring is an ideal, prime ideal, or maximal ideal.
3. Perform operations with ring homomorphisms.
4. Compute with polynomials and determine their reducibility.
5. Demonstrate understanding of key concepts with integral domains.
6. Demonstrate understanding of (abstract) vector spaces, determine whether a subset is a subspace, and determine whether a set of vectors is linearly independent.
7. Analyze the similarities and differences between finite fields and characteristic zero fields.
8. Determine splitting fields and construct extensions fields.
9. Demonstrate understanding of advanced topics in abstract algebra.

COURSE OUTLINE:
1. Review of MATH-370 Topics
   a. Groups
   b. Rings
2. Ideals and Factor Rings (Objectives 1, 2)
   a. Ideals
   b. Prime and Maximal Ideals
   c. Factor Rings
3. Ring Homomorphisms (Objectives 1, 3)
   a. Definition and Examples
   b. Properties
   c. Isomorphisms
   d. Field of Quotients
4. Polynomial Rings (Objectives 1, 4)
   a. Notation and Terminology
b. Division Algorithm and Consequences

c. Factorization

d. Reducibility

e. Irreducibility Tests

5. Integral Domains (Objectives 1, 5)
   a. Principal Ideal Domains
   b. Irreducibles and Primes
   c. Unique Factorization Domains
   d. Euclidean Domains

6. Vector Spaces (Objectives 1, 6)
   a. Definitions and Examples
   b. Subspaces
   c. Linear Independence

7. Fields (Objectives 1, 7, 8)
   a. Extension Fields
   b. Splitting Fields
   c. Finite Extensions
   d. Algebraic Extensions
   e. Finite Fields

8. Advanced Topics (at least two at the discretion of the instructor) (Objectives 1, 9)
   a. Algebraic Coding Theory
   b. Finite Simple Groups
   c. Galois Theory
   d. Geometric Constructions
   e. Sylow Theorems
   f. Other