



**Catalog Description:**

5590H and 5591H includes elementary number theory, group theory, ring theory, abstract linear algebra, field theory, and Galois theory.

**Prerequisite:**

5590H: C or better in 5520H or in 520H, or permission of department.

5591H: C or better in 5590H or permission of department.

**Text:**

Vary, for example:

- *Abstract Algebra*, 3<sup>rd</sup> edition, by Dummit & Foote, published by Wiley, ISBN: 9780471433349
- *Algebra*, by M. Artin
- *Topics in Algebra*, by I. Herstein

**Topics List:**

**5590H:**

1. Integers, unique factorization; congruences, Euler function.
2. Groups, subgroups, homomorphisms and isomorphisms, normal subgroups, quotient groups, permutation groups, cyclic groups, Cauchy Theorems, Sylow's Theorems; direct products, fundamental theorem for finite Abelian group; G-sets.
3. Rings, subrings, ideals, morphisms, polynomial rings, prime and maximal ideals.
4. Commutative rings, factorization theory, Euclidean rings, principal ideal rings, unique factorization domains, Gauss' lemma; illustrations in the integers of quadratic number fields.
5. Modules over commutative rings, submodules, quotients and direct sums; fundamental theorem for modules over principal ideal domains.

**5591H:**

1. Vector spaces (as a special case of modules); linear maps and matrices, canonical forms, dual spaces.
2. The theory of determinants.
3. Bilinear and quadratic forms; inner product and unitary spaces; principal axis theorem.
4. Fields, algebraic and transcendental (extensions), existence of closure (over countable fields), tests for polynomial irreducibility; normality, separability, field automorphisms.
5. Galois theory, the subgroup-subfield correspondence theorem, group theory interrelations; extensions of finite fields, cyclotomic extensions.
6. Solvable groups and solvability by radicals.