

## Algebra Qualifying Examination - Topics

### I. Linear Algebra

Vector spaces, linear transformations and representing matrices, eigenvalues and eigenvectors, diagonalization of matrices, inner product spaces, symmetric, orthogonal, Hermitian, and unitary matrices, Jordan canonical form.

### II. Group Theory

Subgroups, homomorphisms, permutation groups, Sylow theorems, solvable and nilpotent groups, finitely generated abelian groups, generators and relations.

### III. Ring Theory

Ideals, homomorphisms, fields of fractions, polynomial rings (in one and in several indeterminates), PIDs and UFDs, Chinese remainder theorem, Noetherian rings, Hilbert basis theorem, structure of semisimple Artinian rings.

### IV. Fields and Galois Theory

Normal, separable, and Galois extensions, the Fundamental Theorem of Galois Theory, Galois groups of polynomials, finite fields, applications to geometrical construction problems.

### V. Modules

Structure of finitely generated modules over PIDs, applications to linear algebra, tensor products.