

Topics for the Ph.D.-Level Examination in Algebra.

This examination will cover the topics listed in the following three categories:

I. Group Theory.

- (a) Solvable Groups; applications from Galois Theory of Equations.
- (b) Nilpotent Groups; the structure of finite nilpotent groups.
- (c) The Linear Groups, especially over finite fields.
- (d) Semi-direct Products.

II. Homological Algebra.

- (a) Universal concepts defined by diagrams.
 - (i) Free Modules; Projective and Injective Modules.
 - (ii) Tensor Products.
- (b) The Hom-Functor; Exact Sequences.
- (c) Artinian Rings; the Wedderburn-Artin Theorem.

III. Commutative Algebra.

- (a) Rings of Fractions; Localization.
- (b) Rings of Polynomials.
- (c) Integral and Algebraic Closure.
- (d) Noetherian Rings; the Hilbert-Basis Theorem.
- (e) Affine Varieties; the Nullstellensatz.

Suggested Bibliography.

1. Atiyah & MacDonald, Introduction to Commutative Algebra; Addison-Wesley (1969)
2. Hungerford, Algebra; Holt, Rinehart & Winston (1974)
3. Jacobson, Basic Algebra 1; Freeman (1974).
4. Kaplansky, Fields and Rings; University of Chicago.
5. Lang, Algebra; Addison-Wesley (1967).
6. Van der Waerden; Algebra 1, Ungar.
7. Weinstein, Examples of Groups, Polygonal Publishing House (1977).
8. Zariski & Samuel, Commutative Algebra 1, Springer-Verlag (1979).