Algebra Prelim Topics

Groups:

(a) Subgroups, factor groups and homomorphisms;
(b) Special subgroups: centralizers, normalizers, stabilizers;
(c) The Sylow theorems;
(d) Solvable and nilpotent groups;
(e) Direct products and free products;
(f) Free groups;
(g) Group actions on sets, permutation groups;
(h) Structure of finitely generated Abelian groups.

Rings:

(a) Ideals, factor rings and homomorphisms;
(b) Jacobson radical, nil radical;
(c) Noetherian and Artinian rings;
(d) Polynomial rings;
(e) Euclidean domains, principal ideal domains, unique factorization domains;
(f) Local rings and localization;
(g) Primary decomposition;
(h) Direct products and tensor products.

Modules:

(a) Submodules, factor modules, and homomorphisms;
(b) Direct sums and products, and tensor products;
(c) Noetherian modules;
(d) Basic homological algebra: Short exact sequences, projective, injective, and flat modules;
(e) Structure of modules over principal ideal domains.

Fields:

(a) Algebraic and separable extensions; algebraic closure;
(b) Transcendental extensions, transcendence degree;
(c) Galois theory;
(d) Finite fields and their structure.