Oral Qualifying Exam Syllabus

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Week of Monday, December 16, 2013 (tentative)

Committee (in alphabetical order): Stephen Miller (chair), Henryk Iwaniec, Jerrold Tunnell

Algebraic Number Theory
a. Ring of integers in a number field: integral basis, discriminant, and different.
b. Decomposition of primes.
c. Class group and finiteness of class number, Minkowski’s constant.
d. Dirichlet’s theorem on units.

Analytic Number Theory
a. Analytic properties of the Riemann zeta function and Dirichlet L-functions.
b. Dirichlet’s theorem on primes in arithmetic progressions.
c. Prime number theorem.
d. Zero-free regions of Dirichlet L-functions.

Modular Forms
a. Modular forms for the modular group and its congruence subgroups.
b. Eisenstein and Poincare series.
c. Structure of the ring of modular forms.
d. Hecke operators.

Elliptic Curves
a. The group law and isogenies of elliptic curves.
b. Elliptic curves over finite fields, the Hasse bound.
c. Elliptic curves over \( \mathbb{C} \), elliptic functions.
d. Elliptic curves over local fields.
e. Elliptic curves over global fields, the Mordell-Weil theorem.