# Oral Qualifying Exam Syllabus

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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.