Oral Qualifying Exam Syllabus

Matthew Young
myoung@math.rutgers.edu
September 30, 2001

Committee (in alphabetical order): R. Bumby, H. Iwaniec, J. Tunnell.

1. Analytic Number Theory
   (a) Analytic properties of L-functions and the Riemann zeta functions
   (b) Primes in arithmetic progression
   (c) Siegel zero problem
   (d) Prime number theorem and prime number theorem for arithmetic progressions

2. Algebraic Number Theory
   (a) Invariants of number fields: rings of integers, discriminants and orders
   (b) Arithmetic of number fields: splitting of primes, ramification
   (c) Class groups
   (d) Structure of units in number rings

3. Elliptic Curves
   (a) Elliptic curves over the complex field: elliptic functions and the j-function
   (b) Elliptic curves over finite fields
   (c) Hasse-Weil L-functions of elliptic curves

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

5. Elliptic Functions
   (a) The elliptic functions
   (b) The Weierstrass Function, its differential equation, and a parameterization of the cubic.
   (c) The elliptic integrals
   (d) Addition theorems for the elliptic integrals $F(\Phi)$ and $E(\Phi)$
   (e) The elliptic Jacobi functions
   (f) The Weierstrass theorem on functions possessing an algebraic addition theorem