Oral Qualifying Exam Syllabus

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

1. 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) Mellin transform
   (e) Hecke operators

2. Elliptic Curves
   (a) Elliptic functions and the j-invariant
   (b) Elliptic curves over the complex field
   (c) Elliptic curves over finite fields, Hasse-Weil Theorem
   (d) Hasse-Weil L-functions of elliptic curves
   (e) Mordell-Weil Theorem and descent on elliptic curves

3. 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

4. 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