Oral Qualifying Exam Syllabus

Sara Blight
blight@math.rutgers.edu

Week of Monday, September 17, 2007 (tentative)

Committee (in alphabetical order): H. Iwaniec, S. Miller, R. Munshi, 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) Hecke operators
   - (e) Automorphic L-series

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) Elliptic curves over local fields
   - (e) Elliptic curves over the rational numbers, Mordell-Weil Theorem, and descent on elliptic curves
   - (f) Hasse-Weil L-functions of elliptic curves

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

4. Algebraic Number Theory
   - (a) Invariants of number fields: rings of integers, different, and discriminant
   - (b) Dedekind domains
   - (c) Arithmetic of number fields: splitting and ramification of primes
   - (d) Class groups, finiteness of class number
   - (e) Dirichlet's Unit Theorem

References

[1] S. Lang, Algebraic Number Theory, Springer-Verlag, 1986. (Chapters 1-5)

[2] T. Miyake, Modular Forms, Springer-Verlag, 1989. (Chapters 1-4)

[3] H. Montgomery, R. Vaughan, Multiplicative Number Theory I: Classical Theory, Cambridge University Press, 2007 (Chapters 1-11, except 7.4, 8, and 9.4)

[4] J. Silverman, The Arithmetic of Elliptic Curves, Springer-Verlag, 1986. (Chapters 1-8, C.16)