

ORAL QUALIFYING EXAM

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Satadal Ganguly
(email: satadal@math.rutgers.edu)

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

Analytic Number Theory

- a) Analytic properties of Riemann Zeta function and Dirichlet L-functions
- b) Dirichlet's Theorem on primes in arithmetic progressions
- c) Prime Number Theorem. The proof by Hadamard and de la Vallee Poussin
- d) Zero-free regions of Dirichlet L-functions and the exceptional zero problem

Algebraic Number Theory

- a) Ring of integers in a number field. Dedekind's Ideal theory
- b) Decomposition of a prime ideal in a finite separable extension. Hilbert's Ramification theory
- c) Class group and finiteness of class number
- d) Dirichlet's theorem on units

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

Elliptic Curves

- a) Elliptic curves over \mathbb{C} . Elliptic functions, j-invariant
- b) Elliptic curves over finite fields. Hasse's theorem
- c) Elliptic curves over global fields. Mordell's theorem.
- d) Hasse-Weil L-functions