

Syllabus for Oral Qualifying Exam

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- Algebraic Geometry
 1. Varieties, schemes, sheaves of modules
 2. Coherent sheaves, divisors and invertible sheaves
 3. Kähler differentials, cohomology and Serre's duality
 4. Complex algebraic curves and Jacobians
- Elliptic Curves
 1. Group law on elliptic curves
 2. Elliptic curves over finite fields
 3. Reduction of elliptic curves mod p
 4. Elliptic curves over \mathbb{Q} , height function and Mordell-Weil theorem
- Analytic Number Theory
 1. Riemann zeta function $\zeta(s)$ and Dirichlet L-function $L(s, \chi)$, and their analytic continuations
 2. Dirichlet theorem on arithmetic progressions, prime modulus and general modulus
 3. Dirichlet class number formula
 4. Zero-free region for $\zeta(s)$, zero-counting function $N(T)$, and an explicit formula for prime counting function $\psi(x)$
 5. Prime number theorem
- Modular Forms
 1. Modular forms for $SL_2\mathbb{Z}$ and automorphic L-functions
 2. Eisenstein series and the ring of modular forms
 3. Hecke operators