Oral Exam Committee: J. Beck, H. Iwaniec, A. Kontorovich, S. Miller (Chair)

Primary Topic: Diophantine Analysis and the Geometry of Numbers

- Pythagorean Triples
- Infinite Descent and Fermat’s Last Theorem for $n = 4$
- Systems of Linear Diophantine Equations
- Dirichlet’s Approximation Theorem
- Orders of Approximation and Khintchine’s Theorem
- Kronecker’s Approximation
- The Farey Sequence and Hurwitz’s Theorem
- Continued Fractions and the Law of Best Approximations
- A Continued Fraction for $e$
- Irrationality of $\zeta(3)$ and an Irrationality Measure
- The Positive and Negative Pell Equations
- Siegel’s Lemma and Roth’s Theorem
- The Markoff Spectrum
- Markoff Numbers and Markoff Forms
- Hall’s Ray and Gaps in the Spectrum
- Uniform Distribution Modulo 1 and Weyl’s Criterion
- Uniform Distribution of Sequences of Polynomial Values
- Characterization of Normal Numbers
- Minkowski’s First Theorem on Convex Bodies
- Sum of Squares
- The LLL Algorithm and the Shortest Vector Problem
Secondary Topic: Transcendental Number Theory

- Liouville’s Theorem and Liouville’s Constant
- Roth’s Theorem and Champernowne’s Constant
- The Lindemann-Weierstrass Theorem and the Transcendence of $e$ and $\pi$
- The Gelfond-Schneider Theorem and the Transcendence of $\sqrt{2}^{\sqrt{2}}$ and $e^{\pi}$
- The Six Exponentials Theorem
- The Schneider-Lang Theorem
- Mahler’s Classification and Koksma’s Classification

References