Real Analysis (Ph.D.)

Preparatory Courses: Math 5143, 5153

1. Algebras and sigma-algebras of sets, outer measures and the Caratheodory construction of measures, especially for Lebesgue-Stieltjes measures, Borel sets, Borel measures, regularity properties of measures, measurable functions.

2. Construction of the integral with respect to a measure, convergence theorems: Lebesgue dominated convergence theorem, Fatou's Lemma, and monotone convergence theorem, Egorov's Theorem, Lusin's Theorem, product measures and Fubini's Theorem. \

3. Signed measures and the Hahn decomposition theorem, Radon-Nikodym Theorem, Lebesgue decomposition of a measure with respect to another measure, functions of bounded variation, absolutely continuous functions, Lebesgue-Stieltjes integrals.

4. Topology on metric spaces and locally compact Hausdorff spaces, nets, Urysohn's Lemma, Tychonoff, Stone-Weierstrass, and Ascoli Theorems.

5. Introductory functional analysis: Baire Category, Hahn-Banach theorem, uniform boundedness principle (Banach-Steinhaus), open mapping theorem, closed graph theorem, weak topologies, L^p spaces, completeness of the L^1 spaces, Minkowski and Holder inequalities, elementary Hilbert space theory, Fourier series in L^2, Riesz Representation theorems in L^p and C(X).

REFERENCES: Folland, *Real Analysis* ; Royden, *Real Analysis* ; Rudin, *Real and Complex Analysis* ; Hewitt and Stromberg, *Real and Abstract Analysis* .