Qualifying Exam Syllabus for ANALYSIS (MAA 6616-7):

Textbook: Axler, Measure and Integration

Exam Syllabus:

Assumed background knowledge: Students are expected to have proficiency in metric space topoology, including continuity, compactness and connectedness; the Riemann integral; abstract linear algebra.

Fall semester (MAA6616):
(i) Measures: Lebesgue measure on the real line; measurable spaces and functions; convergence proprties of measurable functions.
(ii) Integration with respect to a general measure and limit theorems; e.g., monotone and dominated converges and Fatou's Theorem.
(iii) Lebesgue differentiation and the Hardy-Littlewood maximal function. [Note: the Radon-Nikodym Theorem is included in the Spring term syllabus.]
(iv) Product measures. The iterated integral theorems and integration in real Euclidean space.
Spring semester (MAA6617):
(i) Banach spaces, including the Hahn-Banach and the consequences of the Baire Category Theorem.
(ii) Hilbert space.
(iii) L^p spaces. Holder and Minkowski inequalities. Completeness.
(iv) Signed measures. Total variation, the Hahn, Jordan Lebesgue decomposition theorems; the Radon-Nikodym Theorem. $L^p - L^q$ duality.
(v) Linear maps on Hilbert space. Adjoints, the spectrum, the spectral theorem for compact operators.