Syllabus for the Qualifying Examination in Real Analysis

All sectionnumbers refer to the textbook: Real Analysis, modern techniques and their application, Gerald B. Folland, Wiley sec. edition, ISBN:0-471-31716-0

(1) ELEMENTARY THEORY (Chapter 0): Orderings, Hausdorff Maximal Principle, Zorn's Lemma (0.2), cardinality (0.3), metric spaces (0.6).
(2) GENERAL MEASURES (Chapter 1): σ-algebras and their generators, Borel sets on metric spaces (1.2), measures, σ-additivity, monotonicity, continuity from above and below (1.3), outer measures, Caratheodory's Theorem, construction of Lebesgues and Borel measure (1.4) and (1.5)
(3) MEASURABLE FUNCTIONS AND INTEGRATION (Chapter 2): definition of measurability (2.1), Integration (2.2)and (2.3), Lemma of Fatou (2.2) and (2.3, Ex. 18), Monoton Convergence Theorem (2.2) and Ex. 20, Dominated Convergence Theorem (2.3), modes of convergence: convergence almost every where, convergence in measure (2.4), convergence in L_p (2.4) and(6.1).
(4) PRODUCT MEASURES (Chapter 2): existence (2.5), Theorem of Fubini and Tonelli (2.5), n-dimensional Lebesgues measure (2.6), Jordan content (2.6), Integration Transformation Theorem (using Jacobi determinant) (2.6, theorem 2.44).
(5) SIGNED MEASURES: Hahn Decomposition Theorem (3.1), Jordan Decomposition Theorem (3.1), Lebesgue and Radon Nikodym Theorem (3.2) and (3.3).
(6) DIFFERENTIATION (Chapter 3): Hardy Littlewood's maximal function (3.4) Maximal Theorem (3.4), The Lebesgues Differentiation Theorem on $\mathbb{R}^n$ (3.4), functions of bounded variation and their Jordan decomposition (3.5), absolutely continuity (3.5), the Fundamental Theorem of Calculus (3.4).
(7) TOPOLOGY (Chapter 4): closed, open, open kernel, closure, neighborhood, neighborhood basis, basis of topology (4.1) dense, nowhere dense (4.1), separation axioms (4.1), continuity (4.2), Urison's Lemma (4.2), Titzes Extension Theorem (4.2), nets, convergence of nets, subnets (4.3), compact spaces (4.4) Tichanoff's Theorem (4.6), locally compact spaces (4.5), Arzela-Ascoli Theorem (4.6), Weierstrass Theorem (4.7).
(8) NORMED LINEAR SPACES (Chapter 5): defintion of normed vectorspaces and banach spaces (5.1), linear bounded operators (5.1), linear bounded functionals and dual space (5.2), Hahn-Banach Theorem (5.2), Baire Category Theorem (5.3), its consequences: Open Mapping Theorem, Closed Graph Theorem and Uniform Boundedness Principle (5.3).
(9) TOPOLOGICAL VECTOR SPACES (Chapter 5): topological vectorspaces (5.4) locally convex vectorspaces (5.4), weak and weak* topology (5.4), Alaoglus's Theorem (5.4).
(10) IMPORTANT BANACH SPACES AND THEIR PROPERTIES: Hilbertspace, Schwartz inequality parallelogram law, Bessel's inequality, orthogonality, orthogonal decomposition orthonormal basis (5.5), L_p spaces, Hölder's inequality, Minkowski's inequality completeness of L_p-spaces, dense subspaces of L_p (6.1) the dual of L_p (6.2), Radon measures on locally compact spaces (7.1) regularity of Radon measures (7.2), dual of $C_0(X)$, X locally compact, and $C(K)$, K compact (7.1) and (7.3).