Syllabus for Real Analysis I/II (2 semesters)

-   Preliminaries: Set theory, orderings, axiom of choice, cardinality extended real numbers system etc.)
-   Measures :sigma-algebras, measures, basic properties, complete measures, outer measures, Caratheodory's theorem, Borel measures on the line, Lebesgue measure, Cantor set, Cantor function, regularity.
-   Integration: measurable functions, simple functions, integration of nonnegative functions, Monotone Convergence Thm., basic properties,Fatou's Lemma, Integration of complex-valued functions, basic properties, Dominated convergence Thm., applications, Riemann vs. Lebesgue, types of convergences (in measure, a.e., almost uniformly, Egoroff's Thm.), product spaces and product measures, Monotone Class Lemma, Fubini-Tonelli's theorem, n-dim. Lebesgue integral, relations with Riemann-Jordan measure/integral, change of variables formula, polar coordinates.
-   Complex/Signed Measures and Differentiation: signed and complex measures, Hahn/Jordan decompositions, absolute continuity, Lebesgue-Radon-Nykodym Thm. Differentiation in Euclidean spaces, Hardy-Littlewood maximal function,Lebesgue differentiation Thm., functions of bounded variation, charact. of complex Borel Measures, absolutely continuous functions, Fundamental Thm of Calculus.
-   Elements of Functional Analysis: normed vector spaces, Banach spaces, continuous linear maps, operator norms, linear functionals, Hanh-Banach Thm., Baire Category Thm. , Open Mapping Thm., Closed Graph Thm.,Topological vector Spaces, weak and weak* topologies, Alaouglu's Thm., Hilbert Spaces, Schwarz's inequality, Parallelogram Law, orthonormal sets, Bessel's inequality, completeness, Parseval's identity, o.n. Basis.
-   L^p spaces: Holder's inequality, Minkowski's inequality, basic properties, Dual of L^p, weak L^p.

This is intended to be material that has to be covered by any instructor.

Additional material can be added.