Math 825 & 826 - Mathematical Analysis I & II **2007-2008**
Approximate Syllabus

You may also want to look at listing of topics (and old qualifying exams) on the department's webpage. The following outline may be modified.

Introduction—1 week development of analysis; role of proofs; review of proof techniques

Real Numbers—3 weeks infinite decimals; limits and their properties; upper and lower bounds; subsequences; Cauchy sequences

Series—2 weeks convergence and convergence tests; absolute and conditional convergence

Topology of $\mathbb{R}^n$—2 weeks convergence and completeness; open and closed sets; compactness and the Heine-Borel Theorem

Functions—2/3 weeks continuous functions and their properties; compactness and extreme values; uniform continuity; Intermediate Value Theorem

Calculus—3/4 weeks differentiable functions; the Mean Value Theorem; Riemann integration; Fundamental Theorem of Calculus; Stirling's formula; Riemann-Stieltjes integration

Cardinality—1 week countable sets; diagonal arguments; Schroeder-Bernstein Theorem

Christmas break

Normed Vector Spaces—3 weeks examples and topology; inner product spaces; orthonormal sets and orthogonal expansions

Limits of Functions—3 weeks uniform vs. pointwise convergence; properties of uniform convergence; series of functions and power series

Metric Spaces—3 weeks compactness in terms of open covers and the Borel-Lebesgue Theorem; Baire category; completion of a metric space

Approximation by Polynomials—3 weeks Taylor series; Weierstrass's Theorem; characterizing best approximations; Chebyshev polynomials

Fourier Series & Approximation—3 weeks, or as time allows orthogonality relations; least squares approximation; Riemann-Lebesgue Lem ma; pointwise convergence of Fourier series; Gibbs's phenomenon; Cesaro summation of Fourier series