Analysis Preliminary Exam Syllabus
Department of Mathematical Sciences
University of Cincinnati

Real Analysis

Measure and integration with emphasis on the real line and the plane. Measures and measurable functions, Lusin and Egoroff theorems, Lebesgue integral, Fatou's lemma, monotone and dominated convergence. Convergences: uniform, a.e., in measure, in mean. Product measures, Fubini and Tonelli theorems. Radon--Nikodym theorem. Absolute continuity, bounded variation, and the fundamental theorem of calculus on the real line. L^p-spaces
.
This material is covered in MATH7001

Suggested Texts:
H.L. Royden, P. M. Fitzpatrick, *Real Analysis*, 4e, Pearson, 2010 (Ch.1-7, 17, 18, 20)
G. Folland, *Real Analysis: Modern Techniques and Their Applications*, 2e, Wiley
T. Tao, *An Introduction to Measure Theory*, AMS, 2011
T. Tao, *An Epsilon or Room, I: Real Analysis*, AMS, 2010

Note: While the texts by Tao listed above are physical books, their content is available in his notes posted online on his blog.

Complex Analysis

Complex arithmetic and elementary functions. Complex differentiability, the Cauchy-Riemann equations, complex versus real differentiability. Holomorphic maps: complex versus real differentiability, Cauchy-Riemann equations, conformal and isogonal diffeomorphisms, power series. Complex line integrals. Cauchy's theorem and integral formulas, winding numbers, Morera's theorem, Liousville's theorem, maximum principle, Schwarz's lemma. Harmonic functions. Taylor series. Isolated singularities, Laurent series, residue theorem, argument principle, evaluation of definite integrals, the open mapping theorem. The Riemann sphere and stereographic projection. Conformal mappings, Mobius transformations, Riemann mapping theorem.

This material is covered in MATH7002

Suggested Texts:
Complex Analysis by Lars Ahlfors (3rd edition)
An Introduction to Complex Function Theory by Bruce Palka (1st edition)

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