Dalhousie University
Department of Mathematics and Statistics

Syllabus for Non-specialist Comprehensive Exam in Analysis

The non-specialist comprehensive exam in analysis covers all of the Core Material listed below, together with a **choice of either** Topic A **or two** B topics from the given list of three. The selection must be made in consultation with both the graduate coordinator and the student's supervisor.

Core Material (Compulsory):

Complex Analysis:

1. Holomorphic functions: Cauchy and Morera theorems; contour integration.
2. Taylor expansion: Cauchy's inequalities; Liouville's theorem.
3. Maximum modulus principle; Schwartz lemma.
4. Laurent expansion: residue theorem; application to calculation of integrals.

Suggested References:

1. L.V. Ahlfors, *Complex Analysis*, McGraw-Hill Education, 1980.
2. J.B. Conway, *Functions of One Complex Variable*, Springer-Verlag, 2002.
3. J.E. Marsden, *Basic Complex Anslysis*, W.H. Freeman & Company, 3rd ed., 1998.
4. W. Rudin, *Real and Complex Analysis*, McGraw-Hill Science/Engineering/Math; 3rd ed., 1986.

Real Analysis:

1. Measure spaces: σ-algebras; measures; measurable functions.
2. Lebesgue Integration: integrals of real- and complex-valued functions; monotone and dominated convergence theorems; product measures, Fubini and Tonelli theorems; Lebesgue inetegral in $\mathbb{R}^n$.
3. Elementary Banach space theory; L^p, L^∞ spaces; Hölder's and Minkowski's inequalities; completeness; relations between L^p spaces; duality and L^p spaces.

Suggested References:

1. G.B. Folland, *Real Analysis: Modern Techniques and Their Applications*, John Wiley, 2nd ed., 1999.
2. H.L. Royden, *Real Analysis*, Prentice Hall; 3rd ed., 1988.
3. W. Rudin, *Real and Complex Analysis*, McGraw-Hill Science/Engineering/Math; 3rd ed., 1986.

Topic A: Analysis

1. Möbius transformations and conformal mappings.
2. Construction of measures: *either* locally compact Hausdorff spaces and the Riesz representation theorem, *or* outer measures and Carathéodory's theorem; construction of Borel measures on the real line; Lebesgue measure on the real line.
3. Signed Measures : Lebesgue-Radon-Nikodym theorem.

Suggested References: As listed for the Core Material.