# Guidelines for Analysis Program

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## 1 Description of Courses

### 1.1 Analysis 1, course G101

Text: *Introduction to Analysis*, by Maxwell Rosenlicht.

- Metric spaces.
- Convergence and continuity.
- Differentiation.
- Riemann integration.
- Successive approximations and applications.
- Partial derivatives.
- Multiple integrals.

### 1.2 Analysis 2, course G102

The course will consists of 2 parts. The first part corresponds to chapters 11-14 of the book "Mathematical Analysis" by Andrew Browder. It covers the following topics: introduction to manifolds, differential forms, integration of differential forms on $\mathbf{R}^n$, integration of differential forms on manifolds, Stokes's theorem, vector analysis, harmonic functions.

The second part of the course will contain the introduction to complex analysis. It will contain: the notion of a complex differentiable function, Cauchy-Riemann equation, hydrodynamic interpretation, Cauchy integral formula, power series expression of a holomorphic function, uniqueness theorem, analytic continuation, meromorphic function, residue formula and computation of integrals.

# 2 Analysis Qualifying Exams

## 2.1 Qualifying Analysis 1

- Metric spaces: topology of metric spaces, continuous maps, sequences and limits, compactness, connectedness, completeness, and the contraction lemma.
- Calculus of one variable: basic properties of derivatives and integration.
- Sequences and series of functions: uniform convergence, equicontinuous families of functions.
- Functions of several variables: the differential of a map, the chain rule, inverse and implicit function theorems, integration of differential forms, Stokes' Theorem.
- Existence and uniqueness of ODE, applications.

## 2.2 Qualifying Analysis 2

- Differential forms, integration of differential forms on $\mathbf{R}^n$
- Integration of differential forms on manifolds, Stokes's theorem
- Vector analysis, harmonic functions.
- Complex differentiable function, Cauchy-Riemann equation, hydrodynamic interpretation
- Cauchy integral formula
- Power series expression of a holomorphic function, uniqueness theorem
- Analytic continuation, meromorphic function
- Residue formula and computation of integrals.