GRADUATE COURSE IN ANALYSIS

(1) Banach spaces, Hilbert spaces and L^p spaces
   - Banach spaces: definitions, linear functionals and dual of a Banach space.
   - Hahn-Banach Theorem: extension of linear functionals and separation of convex sets.
   - Weak* topology on dual Banach spaces: strong, weak and weak* topologies, the Banach-Alaoglu Theorem.
   - L^p spaces: Hölder and Minkowski inequalities, completeness and dual of L^p, the case of L^∞.

(2) The theory of Distributions.
   - Distributions: definitions, operations, localization and convergence.
   - Temperated distributions: definitions, properties and the Fourier transform.
   - Fundamental solutions to partial differential equations with constant coefficients.
   - Regularity: weak derivatives, Sobolev spaces, approximates to the identity, Sobolev inequalies and Embedding theorems

(3) The Fourier transform
   - The Schwartz space. The Fourier transform on $\mathcal{S}(\mathbb{R})$.
   - The Fourier inversion formula and the Plancherel Theorem.
   - Applications to partial differential equations.
   - The Poisson summation formula and the Heisenberg uncertainty principle.