Corso di Dottorato: Partial differential equations (30 ore)
(Maria Manfredini)

Elliptic and parabolic partial differential equations.

The Laplace equation as the prototype of an elliptic PDE. Harmonic functions. Representation formula and mean value properties. The fundamental solution. The maximum principle. Subharmonic functions and Perron methodfor the Dirichlet problem.

The heat equation as the prototype of a parabolic PDE. The fundamental solution. The maximum principle. Subcaloric functions and Perron method for the first boundary value problem.

General linear elliptic and parabolic equations: strong and weak solutions.

The regularity of solutions.

The role of the fundamental solutions and the representation formulas in the study of the regularity of solutions.

Poincaré inequality and some of its consequences.

Weak solutions: the Moser iteration method and the Harnack inequality.

Partial Differential Equations with nonnegative characteristic form.

Some classes of examples of degenerate and anisotropic differential equations.

The sublaplacian on the Heisenberg Group.

The second order PDEs of Hörmanders type on homogeneous groups.

Geometry of Hörmanders vector fields.

General Hörmanders operators.

Fundamental solutions: the Levi parametrix method.