Syllabus for Partial Differential Equations

   Preparatory Courses: Math 5233. The course "Partial Differential Equations" intends to familiarize students with the formulas and basic properties of solutions to the usual linear partial differential equations, and with some of the techniques in solving the first-order nonlinear partial differential equations.

1) Laplace's equation: Fundamental solution, mean-value formulas, maximum principle, Liouville's theorem, Green's functions for a half-space and for a ball, energy methods.

2) Heat equation: Fundamental solution, solution formula for the initial-value problem in the whole space, energy methods.

3) Wave equation: D'Alembert's formula, solution formulas for 2-D and 3-D wave equations, reflection method for half-line problems.

4) Nonlinear first-order partial differential equations: the method of characteristics, Hopf-Lax formula for the Hamilton-Jacobi equation, basic concepts in conservation laws, weak solutions.

5) Other methods of solving partial differential equations: separation of variables, transformation methods (Fourier transform and Laplace transform).

REFERENCES: L.C. Evans, *Partial Differential Equations*; F. John, *Partial Differential Equations.*