

## Scuola di Dottorato in Ingegneria “Leonardo da Vinci”

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### Partial Differential Equations of Mathematical Physics

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Durata del corso: 30 ore

**Prerequisiti:** Multi-variable calculus, including the integral (Gauss) theorems – divergence, Stokes, etc. Some matrix theory or linear algebra will be helpful.

**Commenti:** Emphasis on applications and behavior of solutions. Some analytic solution methods. Numerical solutions will not be discussed in any depth.

#### Contenuti del corso:

1. Some typical physical problems which are modelled by first and second order partial differential equations (PDEs)
2. Shallow water waves and their first order PDEs. The vibrating string and its second order hyperbolic PDE. Initial conditions, boundary conditions, properties of solutions.
3. Classification of second order PDEs – elliptic, parabolic and hyperbolic.
4. Heat conduction problems and parabolic PDEs. The maximum principle.
5. Laplace operator – Laplace’s equation, Poisson’s equation, Helmholtz’s equation.
6. Solution methods – separation of variables method and Fourier’s series.

Testo di riferimento: H.F. Weinberger, *A First Course in Partial Differential Equations*, J. Wiley & Sons, New York, 1965.

Some additional notes.