

# Analytical Methods

Helen Wilson, UCL

## Basic Details

This is a 10 hour Core course intended for Applied Mathematics students. It is given in Spring in five 2-hour sessions.

## Course Description

This course is a mixture of perturbation methods and PDEs with the emphasis being on the practical ability to solve problems rather than the theoretical underpinnings. The two major subject areas are interspersed each week, and examples combine them.

## Syllabus

- (1) Introductory material. Regular perturbation expansions. First-order PDEs. Characteristics.
- (2) Scaling and dimensional analysis. Similarity solutions. Homogeneous and inhomogeneous wave equation. Characteristics in second order systems.
- (3) Stretching coordinates. Scale and stretch with nonlinear DEs. Classification of PDEs. Separable solutions.
- (4) Matched asymptotic expansions. Intermediate variables; finding the boundary layer. Laplace's equation: complex characteristics, analytic functions, Cauchy-Riemann equations. Conformal maps.
- (5) Further boundary layer examples. Matching and logarithms. Steepest descents.

## Literature

Hinch, *Perturbation methods*.

Weinberger, *PDEs with complex variables and transform methods*.

## Format

The lecture notes are made available to download from the course website; printed copies are handed out at each lecture.

There are five weekly problem sheets, with full worked solutions made available on the course website.

## Course lecturer

Helen Wilson (UCL). Email: [helen.wilson@ucl.ac.uk](mailto:helen.wilson@ucl.ac.uk); telephone 020 7679 1302.