LTCC Basic Course

Course Title: Analytical Methods

Basic Details:
Core Audience: 1st yr applied mathematics students
Course Format: 5 x 2hr lectures

Prerequisities: Familiarity with partial differential equations (PDE) including standard equations such as Laplace's equation, wave equation, heat equation is expected. Some understanding of standard methods of solving these equations, e.g. separation of variables and transform methods is also required. Some basic tools from complex analysis will be used.

Course Description:

Keywords: perturbation methods; partial differential equations; boundary layers; matched asymptotics; multiscale analysis; WKB

Syllabus:
This course is a mixture of perturbation methods and PDEs.
The content taught each week will be
1. Introductory material. Regular perturbation expansions. First-order PDEs. Characteristics.
2. Singular expansions. Matched asymptotics. Boundary layers. Characteristics in second order systems.
3. Multiscale analysis.
4. The WKB expansion.
5. Complex analytic methods. Boundary value problems. Conformal maps.

Recommended Reading
Bender and Orszag, *Advanced mathematical methods for scientists and engineers.*
Hinch, *Perturbation methods.*
Weinberger, *PDEs with complex variables and transform methods.*

Format:
Printed lecture notes will be available. There are five weekly problem sheets, with full worked solutions made available at the end of the course.

Course lecturer:
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