

## School of Mathematics

### Course 3E1

2003-04

(JS Engineering, option JS MSISS )

**Lecturer:** Dr John Stalker

**Requirements/prerequisites:** 2E1 and 2E2 (Calculus and elementary ODE. Laplace transforms. Theory of series.)

**Duration:** 22 weeks

**Number of lectures per week:** 2 lectures plus 1 tutorial

**Assessment:** Weekly tutorial problems.

**End-of-year Examination:** One 3-hour examination

**Description:** This course follows on directly from 2E1/2E2 and develops the mathematics of engineering and physics. It covers Fourier series, Fourier transforms, partial differential equations, linear programming and optimisation, complex analysis.

- Review of Fourier Methods
  - Algebraic Preliminaries
  - Sampling, Aliasing, etc.
  - Definition of Fourier Series, Transform, etc.
  - Fast Fourier Transform
  - Gibbs Phenomenon
  - Regularity and Decay
  - Filtering and Other Applications
- Partial Differential Equations
  - Laplace's Equation
  - The Heat Equation
  - The Wave Equation
  - Some Other Equation(s)
  - Fundamental Solutions
  - Separation of Variables
  - Finite Differences/Finite Elements
- Optimization
  - Linear Programming
  - Kuhn-Tucker

- Duality
- Graph Theory
- Complex Analysis
  - Power Series
  - The Cauchy-Riemann Equations
  - Familiar Functions Extended to Complex Domain
  - Complex Integrals
  - Residue Tricks

The main topics are stable, but the list of subtopics is subject to change, particularly those towards the end of the course.

See <http://www.maths.tcd.ie/~stalker/3e1> for more information.

**Textbook:**

There is no formal textbook for the course. You can find dozens of books with titles like ‘Advanced Engineering Mathematics’ or ‘Mathematical Methods for Scientists and Engineers’ which cover most of the material for the course. In the library you should be able to find one which has a style of presentation you like and which covers most of the topics listed below. When I cover topics which are harder to find I will suggest references.

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