School of Mathematics

Course 3E1 2002-03
(JS Engineering, option JS MSISS)

Lecturer: Dr James Drummond and Dr. Richard M. Timoney

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.

Fourier Analysis and Partial Differential Equations

This section is based on Kreysig chapters 10-11.

Fouriers Theorem. Even and Odd Functions. Half-Range Fourier Series.

Derivation of Fourier Transform from complex Fourier Series. Linearity of the Fourier transform and the Fourier tranform of a derivative. Application to partial differential equations.

Partial differential equations. Wave equation with d'Alemberts solution. Method of separation of variables applied to solutions of the diffusion (heat) equation, Laplace's equation and the wave equation subject to appropriate initial and boundary conditions. Fourier series applied to matching initial conditions. Natural modes and nodal lines. Classifications of partial differential equations in two variables.

Linear Programming and Optimisation

This section is based on Kreysig Chapter 20 and part of Chapter 21.

It will introduce some basic aspects of linear programming and graph theory.

Complex Analysis

(Kreyszig chapters 12-15)

Complex function and mappings. Complex Differentiation. Analytic functions. Cauchy-Riemann equations theorem and its proof. Harmonic functions. Power series and radius of convergence (without proofs). Exponential, trigonometric and hyperbolic functions (for complex arguments). Logarithm and complex power functions. Mapping properties of some examples.

Complex Integration. Cauchy's integral theorem and its proof. Cauchy's integral formula. Independence of path consequence of Cauchy's theorem and use of the theory to evaluate complex integrals in simple cases (residue theorem not covered). Power series representations in discs.

See `http://www.maths.tcd.ie/~richardt/3E1/` for further information.

Textbook:

Erwin Kreyszig, Advanced Engineering Mathematics, (8th edition) Wiley, 1999.

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