School of Mathematics

Course 3E1 1999-2000
(JS Engineering)

Lecturer: Dr Ralph Kenna

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

Duration: 22 weeks

Number of lectures per week: 2.5

Assessment:

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

Description:

This course follows on directly from 2E1 and develops the mathematics of engineering and physics. It covers complex analysis, Fourier series, Fourier transforms, Laplace transforms, partial differential equations.

Complex Analysis (Kreyszig cpt. 12-15)

Complex function and mappings. Complex Differentiation. Analytic functions. Cauchy-Riemann equations theorem and its proof. Exponential, Trigonometric and Hyperbolic complex functions. Logarithmic and Complex Power functions. Harmonic functions. Conformal mapping applied to two dimensional Laplace equation.

Complex Integration. Cauchy's integral theorem and its proof. Cauchy's derivative formula. Laurent's theorem and its application to representation of functions, classification of singularities and calculation of residues. Proof of important formulae for calculation of residue at a pole of order m. Residue theorem and its proof. Application of residue theorem to calculation of complex integrals such as Inverse Laplace Transform and to real integrals.

Fourier Analysis and Partial Differential Equations (Kreyszig cpt. 10-11)

Fouriers Theorem. Even and Odd Functions. Half-Range Fourier Series. Least Squares Approximation property of Fourier Series.

Derivation of Fourier Transform from complex Fourier Series. Evaluation of some important Fourier transform pairs by contour integration. Relationship between Fourier and Laplace transforms. Application to partial differential equations.

Classifications of Partial Differential Equations. Method of Separation of Variables applied to Solution of the Diffusion Equation, Poisson's Equation and the Wave equation subject to appropriate initial and boundary conditions d'Alemberts Solution. Bending vibration of bars and different boundary conditions. Natural Modes. Application to Heat Transfer Problems.

Textbooks:

Advanced Engineering Mathematics (8th edition) - Erwin Kreyszig - John Wiley.

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