The University Of Sheffield.

Electronic & Electrical Engineering.

MAS242 MATHEMATICS 3 (ELECTRICAL)

Credits: 10

Course Description including Aims

To consolidate previous mathematical knowledge. To provide the necessary mathematical background for control systems analysis, signal processing, communications and for several third year courses involving linear system ideas.

Outline Syllabus

Functions of complex variable: Mapping. Complex functions.
Complex series: Power series. Taylor series. Laurent series.
Laplace transform: Solutions of ordinary differential equations. Convolution.
Fourier transform: Definition and inverse. Fourier series. Replication.

Time Allocation

22 lectures, 11 tutorials

Recommended Previous Courses

MAS156

Assessment

One two-hour written examination. Format: Attempt all four questions.

Recommended Books

Dennis G Zill and Patrick D Shanahan	*A First course in Complex Analysis with Applications*
Dennis G Zill and Warren S Wright	*Advanced Engineering Mathematics*
James, G.	*Advanced Modern Engineering Mathematics*
Saff E.B. and A.D. Snider	*Fundamentals of Complex Analysis with Applications to Engineering and Science*

Objectives

By the end of the module, successful students will:

- have a working knowledge of functions of a complex variable;
- be able to manipulate complex series;
- be able to solve problems involving the use of contour integration;
- be familiar with the properties of the Laplace transform and its inverse;
- be able to solve problems requiring use of the Fourier transform.

Detailed Syllabus

Approximate lecture schedule

Lectures 1-6: Revision of complex numbers, Mappings, Analytic functions, Cauchy-Riemann equations, conjugate harmonic functions. Complex functions.

Lectures 7-11: Complex series, Taylor series, Laurent series, radius of convergence.

Lecture 12-15: Complex integration, poles, singularities. Cauchy's 1st and 2nd integral theorems, residue theorem. Evaluation of certain real integrals using contour integration.

Lecture 15-18: Definition of Laplace transforms, linearity, differentiation with respect to t, differentiation with respect to s, shift theorem. Examples using Laplace transforms to solve initial value problems in ordinary differential equations, transfer function. General inversion formula. Heaviside function, second shift theorem, Dirac delta function. Convolution, causal functions. Stability of systems.

Lecture 19-22: Definition of Fourier transform, symmetry property, shift theorems, scaling property. Periodic functions, Fourier series, Shah function, band limited functions. Replication, sampling, Nyquist interval