

School of Mathematics

Course 3E1 — Engineering Mathematics V
(JS Engineers)

2008-09

Lecturer: Dr. B. Browne

Requirements/prerequisites:

Duration: 14 weeks

Number of lectures per week: 2 lectures + 1 tutorial (5 ECTS)

Assessment: Assessment for this course is carried out by means of a three-hour written examination at the end of the academic year.

End-of-year Examination:

Description:

Textbooks:

Course organization

The course runs in both semesters and comprises of two lectures plus one tutorial per week — the total number of contact hours per student is 42.

Semester	Start week	End week	Lectures Per Week	Lectures Total	Tutorials Per Week	Tutorials Total
1	1	11	2	22	1	11
2	14	16	2	6	1	3
Total contact hours: 42 per student per year						

Course description, aims and contribution to programme

Engineering Mathematics V is a partial-year course for all engineering streams and continues and extends the material from the previous mathematics courses in the first and second years - 1E1, 1E2, 2E1 and 2E2. The emphasis is primarily on analytical techniques with the corresponding numerical methods being taught in 3E2 Engineering Mathematics VI.

Learning outcomes

Upon completion of this course, students will be able to:

- calculate the coefficients of both the complex and the real Fourier series for a variety of functions, and to use them to solve some ordinary differential equations.
- calculate Fourier transforms, discrete or continuous, for a variety of simple functions - students will then be able to use these to compute convolutions in simple cases;

- solve the Laplace, heat and wave equations for a variety of boundary conditions in domains of simple geometry and with simple boundary conditions; the techniques available will include, separation of variables, Laplace and Fourier Transform methods.
- solve linear and non-linear optimization problems.
- apply above methods to solve problems in different areas of engineering.

Course content

- Review of Fourier Methods
 - definition of complex and real Fourier series;
 - application of Fourier series to solve ordinary differential equations;
 - even and odd half-range expansions;
 - definition of Fourier transform;
 - interpretation of Fourier modes as frequencies;
 - convolution.
- Partial Differential Equations
 - Laplace's equation;
 - the heat equation;
 - the wave equation;
 - D'Alembert's solution;
 - fundamental solutions;
 - separation of variables;
 - application of Fourier analysis to initial value problems.
- Optimisation
 - linear programming.
 - non-linear optimization. Lagrange multipliers.
 - Newton's and Conjugate Gradient methods.

Teaching strategies

The teaching strategy is a mixture of lectures and problem-solving tutorials. Whilst the format of lectures is conventional and the atmosphere is informal, some interaction and discussion is common and students are encouraged to ask questions. In the tutorials, all students work on problems which practice and apply the methods introduced in the lectures. Discussion of problems in small groups is encouraged and facilitated.

Recommended texts

Advanced Engineering Mathematics, E. Kreyszig,

September 29, 2008