MATH30021 - 2006/2007

General Information

- Title: Green's Functions, Integral Equations and the Calculus of Variations
- Unit code: MATH30021 (semester 2)
- Credits: 10
- Prerequisites: 253, 256, MT2101, MT2111
- Co-requisite units: None
- School responsible: Mathematics
- Member of staff responsible: Dr David Harris (M/N12b)

Specification

Aims

To introduce students to Green's functions, linear integral equations and the calculus of variations and to develop associated mathematical methods used in applied mathematics.

Brief Course Description

MATH30021 consists of methods of solving various mathematical problems which arise in science. The method of Green's functions is a powerful tool in solving linear ordinary and partial differential equations, and the course starts with an introduction to this topic. There are situations where physical laws are better expressed as integral equations and the course continues starts with Fredholm and Volterra integral equations and their methods of solution. The final section of the course considers some simple problems of the calculus of variations - e.g. showing the shortest path between two points on a plane is a straight line.

Learning Outcomes

On successful completion of this course students will:

- Be familiar with the concepts of integral operator and functional.
- Have acquired sound knowledge of Green's functions, Fredholm and Volterra integral equations and of the calculus of variations.
- Have solved representative problems in applied mathematics using the above, eg solving ordinary and partial differential equations using Green's functions, obtaining and solving linear integral equations and solving typical problems in the calculus of variations, e.g. the isoperimetric problem.

Syllabus

- Green's functions: Definition and basic properties (3).
- Application to the solution of ordinary differential equations(2).
- Application to the solution of partial differential equations(2).
- Fredholm and Volterra equations of the 1st and 2nd kinds(2).
- Fredholm equations with separable kernels(3).
- Neumann series(3).
- Euler-Lagrange equation(s)(3).
- 1st and 2nd functional derivatives(2).
- Lagrange multipliers(2).

Textbooks

Clive R Chester, *ITechniques in Partial Differential Equations,* McGraw-Hill

R Courant and D Hilbert, *Methods of Mathematical Physics, Vols. I and II,* Interscience.

Teaching and learning methods

Two lectures per week plus one weekly examples class. Five hours of private study.

Assessment

Coursework: 20%
2 hours Examination: 80%

Arrangements