Organisation

The MA41003 runs for 11 teaching weeks in the first semester, and is worth 15 SCQF credits (7.5 ECTS points).

**Module Lecturer:** Dr Irene Kyza, Mathematics Division  
**Room:** G12, Fulton Building, **Tel:** 01382 384469  
**E-mail:** ikyza@maths.dundee.ac.uk

**Office Hours:** Tuesday 12:00-13:00, Thursday & Friday 11:00-12:00; or by appointment

You may bring matters of concern about the course to the attention of the Mathematics Division Staff/Student Committee, which meets once each semester. A volunteer will act as class representative to sit on the Staff–Student Committee; their name will be posted on BlackBoard.

Timetable

There will be three classes each week, usually in the form of two lectures and one workshop. There will be one Class Test of one hour duration around the middle of the semester, as well as a two hour final Degree Examination. Throughout the semester four 15 minutes Quizzes will take place; the two with the highest grades will count to your final grade.

Assessment

The overall assessment will be based on:

- Quizzes (10%); in particular they will be given four quizzes and the two with the highest grade will count to your final grade (5% each);
- Class Test (10%);
- A two hour Degree Examination (80%).

Your Commitment

You should attend all lectures and workshops except on medical grounds or with the special permission of the lecturer concerned. If you are absent from the Class Test on account of medical problems, you should submit a medical certificate to your School Office. **No make-up Quizzes will be given.**

Outside of class hours (3 per week) personal supporting study of additional hours per
week is required. This is to include background reading, preparation, and writing of assessed coursework, revision for class tests and the degree examination.

**Study Support**

If you are having difficulty with the course or the coursework you are encouraged to seek help at an early stage at the workshops/lectures/office hours.

**Background**

 Ordinary Differential Equations (ODEs) are an important modelling tool in Science and Engineering. These can rarely be solved exactly and so techniques have been developed to derive approximate solutions that may, in principle, be made as accurate as desired. This module examines the basic numerical methods for the approximate solution of both initial and boundary value problems (IVPs and BVPs). We describe how methods may be constructed, how they may be applied and, via aspects of convergence theory, identify the principal requirements of successful methods. We shall also discuss eigenvalue problems and Green’s functions and their role in solving BVPs.

**Syllabus**

**Part 1: Numerical methods for initial value problems for ODEs**

Taylor Series Methods; Linear multi-step methods: one-step methods (Euler, Trapezoidal and Backward Euler methods) and two-step methods; Consistency, zero-stability, weak stability theory and A-stability; Provision of the extra starting values and the potential for instability; Runge-Kutta methods: construction and weak stability theory; Application to systems.

**Part 2: Boundary value problems for ODEs**

BVPs for second order ODEs; eigenvalues and eigenfunctions; orthogonality; Green’s functions and maximum principles; Finite difference methods: 2nd order methods; Treatment of boundary conditions; Discrete maximum principles; Convergence.

**Feedback**

At the end of the module you will be asked to complete a confidential questionnaire regarding the content and presentation of the module. This is an important element in the University’s Academic Standards procedures.

**Recommended Books**

There are many books in the Library, which cover the material of the module, which may
be useful for reference and revision purposes. Some of these are listed here.


