

University of Dundee

Mathematics Division

MA32005: Fundamentals of Scientific Computing

Course Guide 2010 - 2011

Organization

The MA32005 module runs for 11 teaching weeks in the second semester. The lecturer is

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You should make an appointment to see the lecturer if you have a problem regarding the course. You may also bring matters of concern about the course to the attention of the Mathematics Division Staff/Student Committee, which meets once each semester.

Syllabus

In order to take this course you should have passed modules MA21001 and MA22001, or have an equivalent qualification.

Matrix algebra is a fundamental and widely used resource for modeling a wide variety of problems in science, technology, industry and commerce.

The aim of this course is to use computers to implement algorithms to solve a number of problems that can be stated in terms of matrix-related equations, and to understand the relevant matrix theory that underpins these algorithms.

Course Content

Computer Arithmetic and Roundoff Errors

Number system, floating point representation, round-off and truncation errors, catastrophic cancellation, numerical instability.

Direct Methods for Solving Linear Systems of Equations

Gaussian elimination, LU-factorization, partial pivoting, norm and condition number

Iterative Methods for Solving Linear Systems

A general iterative method and convergence, Jacobi method, Gauss-Seidel method, SOR (successive over-relaxation)

Iterative methods for Eigenvalue Problems

Gram-Schmidt orthogonalization, QR factorizations, review of eigenvalue problems, power method, QR method.

Using MATLAB to solve problems in linear algebra

Introduction to MATLAB, implementation of algorithms such as Gaussian elimination and iterative methods for linear systems, QR factorization, and eigenvalue computations.

Assessment

There will be three pieces of assessed MATLAB course-work which together count for 30%. The remaining 70% will come from the degree examination, which will be held in the May diet of Degree Examinations. Honours degree examinations will be two hours in length. The pass mark will be 40% overall.

If you score less than 40% overall, you will be able to sit an examination in the resit Degree Examination Diet held in August. In this case 100% of the assessment mark is from this examination. The pass mark will be 40%. For the purposes of Honours Classification any pass achieved at the resit diet will be capped at 40%.

If you are unable to attend an element of assessment (such as a Class Test or a Degree Examination because of illness, **you must supply a medical certificate** covering the relevant period to your School Office. If illness prevents you from attending other meetings of the class, please keep your School Office informed of the reasons for your absence.

Feedback

At the end of each section 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.

Reference Books

[1] *Numerical Analysis* by R.L. Burden and J.D. Faires (Publisher: Brooks/Cole).

[2] *Numerical Linear Algebra* by Lloyd N Trefethen and David Bau, III (Publisher: SIAM, 1997).