University of Dundee
Mathematics Division


Organisation
The MA21001 module contains components of Calculus and Algebra which run concurrently for 11 teaching weeks in the first semester, and is worth 20 SCQF credits (equal to 10 ECTS points). All organisation and teaching will be carried out by

**Calculus:** Dr Raluca Eftimie
- Mathematics Division
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- Fulton Building
- Tel: 01382 384488
- email: reftimie@maths.dundee.ac.uk

**Algebra:** Prof. Gunnar Hornig
- Mathematics Division
- Room G1E
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The Module Leader is Prof Hornig. You should make an appointment to see one of the lecturers 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. A volunteer from MA21001 and MA22001 will act as class representative to sit on the Staff–Student Committee; their name will be posted on BlackBoard.

The weekly timetable for the module consists of six 50 minute classes (details on the University timetable).

Assessment
The overall assessment will be based on your marks in the Coursework (40%) and the Degree Exam (60%). Coursework for this module consists of 10 Problem Sheets for each half of the course. A number of these assignments may be assessed under timed conditions in class hours using the MapleTA system. Assignment deadlines will be posted on MyDundee and announcements made in class hours.

To pass this module in December it is necessary to gain at least 40% in the overall assessment and gain at least 30% in the Degree Examination and obtain an average of at least 30% in the Problem Sheets.

For those who fail the module in December there will be a two-hour resit examination paper at the August Examination diet. To pass this module in August it is necessary to gain at least 40% in the August Examination.

The Director of Studies may debar a student not performing at a satisfactory level in the continuous assessments from entering the Degree Examination in December.

A medal may be awarded to the best student in the class.

Syllabus
This module contains the first half of the basic algebra and calculus required for intending honours students. The module may also be taken by science and arts students not intending to proceed to an honours mathematics degree. This module involves approximately 200 hours of student effort, including 66 contact hours.
Calculus component

Differential Equations
Revision of linear differential equations of second order with constant coefficients using undetermined coefficients.
General solutions and solutions satisfying initial conditions.
Resonance. Equations of higher order.

Hyperbolic Functions
Hyperbolic Functions; Solution of simple equations, inverse functions.
Revision of standard methods of definite integration, including hyperbolic substitutions.

Fundamentals of Calculus
Limits, Continuity and Differentiability.
Rolle’s Theorem, Mean Value Theorem.
Definition and properties of the Riemann integral, Fundamental Theorem of Calculus.
L'Hôpital’s Rule and Indeterminate Forms.
Infinite and improper integrals. Taylor & Maclaurin series.

Algebra component

Vectors and vector spaces
Definition of a vector space, \( \mathbb{R}^n \). 
Vectors, lines and planes in \( \mathbb{R}^n \). 
Span, linear independence. 
Basis and dimension. 
Subspaces.

Inner product
Scalar product, length. 
Projection. 
Normal form of hyperplanes in \( \mathbb{R}^n \). 
Orthogonality.

Linear equations and matrices
Systems of linear equations. 
Gaussian elimination. 
Matrices and matrix operations, transposes and inverses. 
Matrix equations. 
LU factorisation. 
Determinants.

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 unable to attend the degree examination or complete elements of the coursework on time (e.g. hand in homework solutions) then you should inform the Module Leader and submit a medical certificate. Medical certificates should be submitted to your School Office (for students advised by Mathematics this is the Office for the School of Engineering, Physics and Mathematics and is in the Fulton Building).
Study Support

If you are having difficulty with the course you are encouraged to seek help at an early stage by making an appointment to see one of the lecturers. You may also obtain additional help from the Maths Base (see BlackBoard for details) or your Personal Tutor.

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.

Recommended Books

The main texts for this module are:

*Calculus Early Transcendentals (Brief), 8th Edition*

by Howard A. Anton, Irl Bivens, Stephen Davis

Publisher: John Wiley & Sons, New York.

*Linear Algebra* by David Poole


Many similar textbooks may be found in the University Library.