

## School of Mathematics

### Course 1S3 — Mathematics for Science students

2006–07

(JF Mathematics as a whole subject within the Science Moderatorships. JF Human Genetics. JF Computational Chemistry. JF Medicinal Chemistry. JF Physics & Chemistry of Advanced Materials. )

**Lecturer:** Dr. R. M. Timoney

**Requirements/prerequisites:** None

**Duration:** 24 weeks

**Number of lectures per week:** 2 lectures per week plus a tutorial every second week. Computer lab in first term.

**Assessment:** Practical work, assignments, tutorial work and computer lab assignment results will count for 20% of the marks, with the paper counting for the remaining 80%

**End-of-year Examination:** Three hour exam. Result is combined with results of 1S1 and 1S2.

### Description:

- Practical computing work  
General use of UNIX computer system (email, web page creation, use of network); use of Mathematica. One hour per week in Michaelmas Term.
- Introduction to computing  
Binary, octal and hexadecimal integers; storage of integers and floating point numbers in computers (via bits).
- Introduction to symbolic computing  
Use of a computer algebra system. Facilities of the system for elementary number theory and algebra. Elementary facilities for differentiation, integration and differential equations. Plotting and the mathematical basis. User defined functions.  
Anton, Bivens & David, Calculus (8th edition): 1.2, 1.7, Chapter 4, exercises in Chapters 3, 5–10 marked CAS or ‘graphing utility’.  
Mathematica book Part 1 (less than what is in section 1.1–1.9).
- Differential Calculus  
Maxima and minima and plotting (with the aid of symbolic computation); parametric plots. Linear approximation, root finding using Newton’s method.  
Anton, Bivens & David, Calculus (8th edition): Chapter 4 (except 4.7) and section 3.9.
- Integration  
The concept of a definite integral (area or Riemann sum). Elementary algorithms for computing definite integrals (trapezoidal and Simpson’s rules). Fundamental Theorem of

Calculus and antiderivatives Techniques of integration and standard applications (backed up by practical work using computer algebra).

Anton, Bivens & David, Calculus (8th edition): 5.1, 5.4–5.6, 6.1–6.4, 8.5–8.8.

- An introduction to probability and statistics

The notion of a probability on a sample space, mean and standard deviation for random variables, sample mean and sample variance, the binomial, poisson and normal distributions.

Kreysig: 24.1–24.3, 24.5–24.8. (The similar sections in the 8th edition are 22.1–22.3, 22.5–22.8.)

There is a web page for this part of the course, which is updated during the year. The address is <http://www.maths.tcd.ie/~richardt/1S3>.

### *Essential Reference*

1. Howard Anton, Irl Bivens & Stephen Davis, Calculus, 8th Edition, Wiley (2005)

### *Recommended references*

1. Erwin Kreyszig, Advanced Engineering Mathematics, (9th edition) Wiley, 2006.
2. S. Wolfram, Mathematica book, Addison-Wesley (5th edition) 2004, published by Wolfram Media and Turnaround, London.

October 11, 2006