School of Mathematics

Course 1S3 — Mathematics for Science students 2003–04
(JF Mathematics as a whole subject within the Natural Science Moderatorships. JF Human Genetics. JF Computational Physics and 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: 2.5 lectures per week plus a tutorial every third week.

Assessment: Practical work, assignments, tutorial work and '061' 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 1S2/4.

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 (Calculus, 6th edition): 1.3, 1.7, Chapter 5, exercises in Chapter 2–3, 7–10 marked CAS or 'graphing calculator'.
  or
  Anton, Bivens & David, Calculus (7th edition): 1.3, 1.8, Chapter 4, exercises in Chapters 3, 5–9 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 (Calculus 6th edition): Chapter 5 and section 3.6.
  Anton, Bivens & David, Calculus (7th edition): Chapter 4 and section 3.8.

- 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 (Calculus, 6th edition): 7.1, 7.5–7.7, 8.1–8.4, Chapter 9.
Anton, Bivens & David, Calculus (7th edition): 5.1, 5.4–5.7, 6.1–6.4, Chapter 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: 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, 7th Edition, Wiley (2001)
   or
   Howard Anton, Calculus: a new horizon (6th edition), Wiley, 1998.

Recommended references

1. Erwin Kreyszig, Advanced Engineering Mathematics, (8th edition) Wiley, 1999.
2. S. Wolfram, Mathematica book, Addison-Wesley (4th edition) 1999, published by Wolfram Media and Cambridge University Press.

October 7, 2003