School of Mathematics

Course 1S — Mathematics for Science students 1998-99
(JF Mathematics as a whole subject within the Natural Science Moderatorships. JF Human Genetics. JF Computational Physics and Chemistry.)

Lecturer: Dr. S. McMurry, Dr. B. Redmond, Dr. R. M. Timoney & Dr. T. G. Murphy

Requirements/prerequisites: None

Duration: 24 weeks

Number of lectures per week: 8 lectures per week including course 061 (1 lecture per week for part of the year; separate course description)

Assessment: The three main sections of the course will count equally towards the overall result for the course. Two end-of-term assignments assignment will each count for 10% of the marks for section 2. Practical work, assignments, tutorial work and 061 assignment results will count for 1/4 of the marks for section 3, with the paper counting for the remaining 3/4.

End-of-year Examination: Three 3-hour exams on each section, papers 1, 2 and 3

Description:

Section 1 *Dr. S. McMurry*

- Differentiation of functions of one variable.
- Antiderivatives and integration.
- Trigonometric and hyperbolic functions, and the corresponding inverse functions; logarithmic function, exponential function.
- Introduction to partial derivatives.
- Polynomials, sequences and series, including simple convergence tests.
- Complex numbers.
- Matrices, determinants and systems of linear equations.

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/pub/coursework/1S1

Section 2 *Dr. B. Redmond*

Vectors and differential equations (in Michaelmas term), particle and rigid body mechanics. More detailed outline:

- Vectors, addition, scalar product, cross product, vector equation of a line in 3 dimensions, triple vector product, differentiation. (8 lectures)

- Ordinary Differential Equations of first and second order. Linear differential equations with constant coefficients. Nonhomogeneous. (10 lectures)

- Introduction to Classical Mechanics. Kinematics of a particle, relative motion, forces, Hooke's law, Newton's law of gravitation, friction. Work done by a force, conservative forces. Potential function, Energy equation. Motion of a particle with constant acceleration, motion under gravity with resistance.

- Simple Harmonic motion, with and without resistance, impulsive motion and coefficient of restitution. Two dimensional motion, projectiles, Polar coordinates, components of velocity, acceleration, central forces.

Section 3 *Dr. R. M. Timoney*

- 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 procedures.

- Differential Calculus
  Maxima and minima and plotting (with the aid of symbolic computation); parametric plots. Linear approximation, root finding using Newton's method.

- 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).

- 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 normal distribution.

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/pub/coursework/1S3

Recommended references

1. Howard Anton, Calculus: a new horizon (6th edition), Wiley, 1998. (volumes 1&2 separately, or combined volumes 1-3).

2. Howard Anton, Calculus with analytic geometry (5th Edition), Wiley 1995.

3. Erwin Kreyszig, Advanced Engineering Mathematics, (7th edition) Wiley, 1993.

4. H. Mulholland & J.H.G. Phillips, Applied Mathematics for Advanced Level (2nd edition), Heinemann, 1985.

5. O. Murphy, Fundamental Applied Mathematics, Folens, 1986.

6. S. Wolfram, Mathematica a system for doing mathematics by computer, Addison-Wesley (3rd edition) 1996, published by Wolfram Media and Cambridge University Press.

7. G. B. Thomas & R.L. Finney, Calculus and Analytic Geometry (9th edition), Addison Wesley, 1996.

School of Mathematics

Course 061 — Computing 1998-99
(JF Mathematics, Theoretical Physics, Two-subject Moderatorship, & JF Science)

Lecturer: Dr. T.G. Murphy

Requirements/prerequisites: None

Duration: 2 terms

Number of lectures per week: 1 (first term only)

Assessment: Assignments

End-of-year Examination: None

The course has 4 main aims:

- To introduce the student to Unix computer systems in general, and to the Unix system in the School of Mathematics in particular.
- To offer a taste of the facilities available on the Internet.
- To teach the programming language Java.
- To introduce the LaTeX system for printing mathematics.

The course is entirely practical in character. At the end of the course you should be able to use a Unix system with confidence; should be able to use the Internet for sending mail, for accessing the World-Wide-Web, and for other purposes; should be able to write simple programs in C++; and should be able to present mathematical documents in LaTeX.

December 9, 1998