

MATH1400: Modelling with Differential Equations

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WWW: <http://www.maths.leeds.ac.uk/~alastair/MATH1400>
- 10 credits, Semester 2, 2011–12
- Pre-requisites: A-level Mathematics, MATH1050 or equivalent.
- Aims: To introduce the concept of mathematical modelling. To illustrate its application in various areas and to develop relevant methods for the solution of first and second order ordinary differential equations (ODEs).
- Objectives: On completion of this module, students should be able to: (a) set up simple first and second order differential equations to model processes such as radioactive decay, Newton cooling, population growth and mixing problems; (b) solve first order differential equations of various types such as separable, homogeneous, linear, and to apply initial conditions to the general solution; (c) solve second order linear differential equations with constant coefficients by finding complementary functions and particular integrals, and to apply either initial or boundary conditions.
- Outline syllabus: 1. The modelling process via simple examples: exponential growth and decay etc. 2. Solution of first order ODEs: linear via integrating factor, nonlinear via substitutions. 3. Application of first order ODEs to modelling population growth, etc. 4. Solution of second order ODEs (linear with constant coefficients) and simultaneous ODEs. Reduction of order. 5. Application of second order ODEs to examples.
- Form of teaching and schedule: two lectures and one tutorial every week:

Thursday	12:00–13:00	Chemistry West Block LT F
Friday	11:00–12:00	Roger Stevens LT 20
Friday	12–1, 1–2 or 2–3	Tutorials, various locations (please check your timetable)
- Form of assessment: 5 Example sheets (10%). 4 quizzes (10%). One unseen 2 hour examination at end of semester (80%). The quizzes will be held during every other tutorial, starting on Friday 17th February.
- Dates for handing in examples sheets: Examples 1: 13 February. Examples 2: 27 February. Examples 3: 12 March. Examples 4: 23 April. Examples 5: 8 May.
- Dates of quizzes: Quiz 1: 17 February. Quiz 2: 2 March. Quiz 3: 16 March. Quiz 4: 27 April.

- Office hours: Tuesdays 2:30–3:30pm in my office, or email me for an appointment.
- You can find videos of lectures 7–22 of the course as given in 2008 on LUTube (link via VLE or course web page). Please note that the syllabus has changed somewhat since then.
- Lecture notes for this module have been developed and prepared by Prof. Alastair Rucklidge, who wishes to thank and acknowledge the contribution of Dr E. Cole and Dr C. Molina-París for their lecture notes and assistance with producing the typed version of these notes.

Book list:

W. E. Boyce and R. C. DiPrima, “Elementary differential equations and boundary value problems”, Wiley, 2005.

F. R. Giordano and M. D. Weir, “Differential equations: a modeling approach”, Addison-Wesley, 1991.

K. F. Riley, M. P. Hobson and S. J. Bence, “Mathematical methods for physics and engineering”, Cambridge, 2006.

D. G. Zill, “A first course in differential equations with modeling applications”, Brooks/Cole, 2005.

Useful resources:

Course web page: <http://www.maths.leeds.ac.uk/~alastair/MATH1400>

The Library has lots of books on differential equations beyond the ones listed.

The Leeds Skills Centre has a Maths drop-in service open every day during term. They can be found at 15 Blenheim Terrace; see http://skills.library.leeds.ac.uk/one_to_one.php.

There is online help at: http://skills.library.leeds.ac.uk/topic_improving_your_maths.php and at <http://www.mathcentre.ac.uk/students.php/mathematics/>.