Maths 260: Differential Equations
Study Guide: Semester 2 2011

This document contains important information about the course Maths 260. Please read it carefully. You should keep this document for future reference.

Lecturers & Contacts

Your lecturers are here to help you. You are welcome to speak to them about any aspects of the course. If you want to talk to your lecturer, you can either speak to them after a lecture or in office hours, or you can make an appointment to meet at another time.

The lecturers for this course are:

- Dr Claire Postlethwaite (course coordinator): Room 313, Building 810,
  Email: `c.postlethwaite@math.auckland.ac.nz`
  Office hours: Monday 2pm, Wednesday 1pm and Thursday 9am.
- Dr Kate Patterson: 70 Symonds St,
  Email: `k.patterson@math.auckland.ac.nz`
  Office hours: Wednesday 10am and 3pm, Friday 1pm.
- Michael Smith: 70 Symonds St
  Email: `m.smith@math.auckland.ac.nz`
  Office hours: Monday 10am-noon, Friday 11am.

Lectures & tutorials

The lectures are at 9am, Monday, 11am Tuesday, and 9am Friday. You should also enrol in one tutorial. Tutorials start in the **first week** of semester.

Assignment due dates

There will be four assignments. The due dates are Tuesday 9th August, Tuesday 23rd August, Tuesday 27th September and Friday 15th October. Assignments should be handed in by **4pm** on the due date to the boxes in building 303 outside SciSpace. **Late assignments will not be accepted**.

Test

There will be a one-hour **in class** test on Friday 16th September. All students should take the test.

Textbook

You are expected to read the textbook! You *must* prepare for lectures and review them afterwards - it is not enough just to sit through lectures and expect to do well.

1 Course Description

The study of differential equations is central to mathematical modelling of systems that change. This course develops methods for understanding the behaviour of solutions to ordinary differential equations. Qualitative and elementary numerical methods for obtaining information about solutions are discussed, as well as some analytical techniques for finding exact solutions in certain cases. Some applications of differential equations to scientific modelling are discussed. This is a core course for Applied Mathematics.

1.1 Pre-requisites & Restrictions

Before enrolling in this course, you should already have passed Maths 150 or Maths 208, or have passed an equivalent course. Speak to your lecturer if you have any concerns about your mathematics background.

1.2 Expectations

It is expected that students in this course will spend 10 hours per week working on this course. The normal pattern of student study is expected to be (on average, each week):

- 3 hours lectures
- 1 hour tutorial
- 4 hours lecture and tutorial preparation and review
- 2 hours assignments and exam preparation.

Students are expected to attend all lectures and tutorials. After each lecture you should review the material from the lecture and try any examples recommended in the lecture. Details of material to be covered in the next lecture will be announced in class — you are expected to preview the material in the text before you come to the lecture. Tutorials are a chance for you to work through problems and get assistance with them, and to experiment using the computers. Written answers to tutorials will not be distributed.

1.3 Topics covered in the course

The list below shows the topics that will be covered in the course and the order in which the material will be taught. Corresponding chapters in the textbook (3rd edition) and approximate allocation of lectures for each topic is indicated. Not all material in the indicated chapters will be covered in the course.

- First order differential equations [13 lectures] (Text, sections 1.1-1.9). Introduction to differential equations and modelling with differential equations. Introduction to the software package Matlab. Separable equations and linear equations. Slope fields. Numerical methods (introduction only). The phase line, equilibria, and bifurcations.
- First order systems of differential equations [16 lectures] (Text, sections 2.1-2.5, 3.1-3.5, 3.8, 5.1, 5.2). Phase plane and qualitative analysis. Linear systems, including classification of equilibria. Nonlinear systems, including classification of equilibria.
- Higher order differential equations [5 lectures] (Text, sections 3.6, 4.1-4.2).

2 Assessment

The final grade for the course will be calculated as follows:

- Final exam (2 hours) 60%
- Mid-semester test 20%
- Four assignments 15%
- Tutorial 5%

Assignment due dates are Tuesday 9th August, Tuesday 23rd August, Tuesday 27th September and Friday 15th October. Assignments should be handed in by **4pm** on the due date to the assignment hand-in boxes on the ground floor of building 303 outside G16, SciSpace. **Late assignments will not be accepted**.

A one-hour test will be held, in class, on Friday 16th September, at 9am (room to be advised). All students should take this test.

If illness or other problems prevent you from completing any of the assignments you should contact your lecturer as soon as possible. A medical certificate will be required if you wish to apply for exemption from an assignment. If you are ill at the time of the test or exam you should contact Student Health and Counselling (telephone 373-7599 extension 87681) immediately to obtain information on how to apply for an aegrotat or compassionate pass.

2.1 Calculators

Calculators **are not allowed** in the test and final exam.

3 Resources

3.1 Textbook

The text for this paper is Differential Equations, by P. Blanchard, R. Devaney and G. Hall (first, second or third edition).

This textbook is very good, and the course makes extensive use of the book. **You must read the textbook.** There are several copies of the text on short loan in the Library. The book costs about $189.00 new after student discount. There will also be second hand copies of the text available.

3.2 Use of Undergraduate Computer Laboratory

In order to complete assignment and tutorial problems and to understand lecture material, students will be required to use the software package Matlab in the Undergraduate Computer Laboratory. A map showing you how to find the Teaching Laboratory and a brief guide to the labs can be found by following the links from the webpage:

`http://www.scl.ec.auckland.ac.nz`

3.3 Doing well in Maths 260

Here are some suggestions for doing well in Maths 260.

- Plan to spend 10 hours each week working on this course. This includes attending lectures, reading the textbook and doing assignment questions.
- Try hard not to miss lectures and tutorials. If you miss a lecture, get the lecture notes from the web site and go over them before the next lecture or tutorial. If you miss a tutorial, get a copy of the tutorial question sheet from the course website and go over the questions before the next lecture or tutorial.
- To get the most out of each lecture, review the material from the previous lecture before coming to class. You can also read any recommended sections in the textbook - these are usually listed on the lecture notes from the previous lecture.
- You can only learn mathematics by doing mathematics and it is important to supplement lecture material by trying some of the recommended problems from the textbook. Problems appropriate to each lecture will be given during each lecture. Try some of the problems every week. Don't wait until it is time to study for the exam.
- Attempt all the assignment questions. Once your assignment is marked, go over the assignment to check where you made mistakes. Sample solutions to the assignments will be distributed - read them, as they contain helpful information such as alternative ways to answer questions.
- If you are having problems with material in the course, first make sure you have read the appropriate parts of the lecture notes and the textbook. Then speak to your lecturer, either in lectures or tutorials or make an appointment with your lecturer. Good ways to make an appointment are by speaking to your lecturer after class or by emailing your lecturer. Don't be scared to approach your lecturers for help - they are happy to help students who are trying to help themselves.
- Some help with Maths 260 may also be available in the Mathematics Department assistance room (Room G16 in the Maths Building), starting from the second week of semester.
- If you need help with computer use in the computer laboratory, ask a demonstrator in the laboratory. Demonstrators on duty will be wearing a sash and there will always be a demonstrator on duty when the Maths/Stats laboratory is open. If the demonstrators are unable to help you with details of the Matlab package used, then ask your lecturer for help.
- To prepare for the test or exam, first make sure you understand your lecture notes and make sure you can do all assignment and tutorial questions. Go over some old exam papers (these can be downloaded from the University Library webpages). The recommended problems listed in lectures can be used for extra practice. If you have problems, see your lecturer.

4 Administrative information

4.1 English Language Assistance

If students require assistance with English there are several services provided by the university and by the Department of Mathematics. The main assistance is ELSAC, the English Language Assistance Centre, which has a website: `http://www.elsac.auckland.ac.nz/` This computer-laboratory based service is free and open seven days a week. Tutors are available to help. Alternatively, there are credit-bearing English language courses (ESOL 100/101/102 see p337 of the 2006 Calendar). The Department of Mathematics offers special tutorial support for Maori and Pasifika students (contact Garry Nathan, telephone 373-7599 extension 84931, or Viliami Latu, telephone 373-7599 extension 83063), and occasionally runs Mandarin or Cantonese-speaking tutorials (contact Jamie Sneddon, telephone 373-7599 extension 82121).

4.2 Collaborating & Cheating

You are encouraged to discuss problems with one another and to work together on assignments, but you must not copy another person's assignment. Assignment marks contribute to the final mark you receive in this course. We view cheating on assignment work as seriously as cheating in an examination. Generally acceptable forms of collaboration include:

- Getting help in understanding from staff and tutors.
- Discussing assignments and tutorial examples and methods of solution with other students.

Generally **unacceptable** forms of collaboration ('cheating') include:

- Copying all or part of another student's assignment, or allowing someone else to do all or part of your assignment for you.
- Allowing another student to copy all or part of your assignment, or doing all or part of an assignment for somebody else. This is treated as seriously as copying another student's assignment.

If you are in any doubt about the permissible degree of collaboration, then please discuss it with a staff member.

Register of Deliberate Academic Misconduct

Beginning in 2009, if a student deliberately cheats and receives a penalty, the case will be recorded in a University-wide Register. The record of the offence will normally remain until one year after the student graduates. The Register will help identify repeat offenders, with the risk that these students will receive more severe penalties for repeat offences.

4.3 Harassment & Complaints

Complaints about marking should be taken to your lecturers who are in a position to do something immediately. More general complaints can be taken up by your class representative. You may also approach the Head of Department or the Departmental Manager for Mathematics.

Harassment on any grounds, such as racial, sexual, religious and academic is totally unacceptable. Complaints about harassment are best taken to the University Mediator

(extension 87478) or to any member of the Resolve Network whose names are displayed on posters around campus.