

# MATHS 270SC: Numerical Computation

## Study guide 2011

### Course summary

MATHS 270 is a 15 point course that gives an introduction to the computational techniques frequently used to solve the models that arise in Applied Mathematics. Topics covered include methods for solving linear and nonlinear algebraic equations, interpolation and quadrature (integration) of functions and the numerical solution of ordinary differential equations. This is a core paper for students whose primary interest is in Applied Mathematics.

### Lecturers, lectures and laboratory tutorials

#### Lecturers

Dr Allison Heard, Extension 88816, heard@math.auckland.ac.nz.

David Duan, wdua004@aucklanduni.ac.nz.

Allison Heard is the course coordinator.

#### Office Hours

**Lectures** Monday, Wednesday and Thursday at 10am in Clock Tower Room 029.

**Tutorials** You should have enrolled in a tutorial in Student Services Online. These will start in the second week of semester.

*If you have not done Matlab before please come in the first week - Tuesday 19 July at 9am in GTL (G75 on ground floor of building 303S).*

### Assessment

- 5% for tutorials
- 15% for assignments
- 20% for the mid-semester test
- 60% for the final exam

### Assignments

- Four assignments.
- Past years of MATHS 270 have suggested there is a good agreement between the number of assignments you attempt and whether you pass the course.
- The assignments are due in 4:00pm on the following dates:
  - Assignment 1: Friday 5 August
  - Assignment 2: Friday 26 August
  - Assignment 3: Friday 30 September
  - Assignment 4: Friday 14 October.
- Assignments are handed in to the boxes on the Ground Floor outside SciSpace (G16). Three days before the assignment due date, boxes will be labelled for this course. If you wish to hand your assignment in *earlier*, then there will be a box for any early assignments. This box will be cleared daily, the assignments date stamped and kept until the due date. Any assignments in this box after the due date will *not be marked*.
- Each assignment will be made available on Friday the week before the assignment is due in i.e. you will have 7 days to do the assignment.

## Mid-semester test

The test will be held in *lecture time* on Wednesday 14 September. The room will be announced later. Check the details during the semester, in case it is necessary to make any changes. It will cover up to the end of the lecture on 25 August. You will be tested on MATLAB in the final exam, but not in the mid-semester test.

## Recommended preparation

**Mathematics** One of the following:

- MATHS 150
- MATHS 108

**Computing** One of the following:

- MATHS 162
- COMPSCI 101
- A good grade in COMPSCI 105

## Syllabus

1. Review of matlab (1 lecture);
2. Iterative methods for linear algebraic equations - Jacobi, Gauss-Seidel (4 lectures);
3. Scalar nonlinear equations - Linear models, iterative schemes, convergence, difficulties with the methods (5 lectures);
4. Direct methods for linear algebraic equations - LU factoring, pivoting, conditioning; (4 lectures);
5. Systems of nonlinear equations - Newton's method, finite differencing, continuation, use in unconstrained optimisation (5 lectures);
6. Interpolation - Newton divided differences, uniqueness of the interpolant, interpolation error, Vandermonde approach for general interpolation problems, Hermite cubic interpolation (4 lectures);
7. Numerical differentiation, Quadrature - Newton-Cotes, error estimation, Gauss-Legendre, composite rules (6 lectures);
8. Ordinary differential equations - simple one-step and multi-step methods, behaviour of the error (6 lectures).

## Expectations

MATHS 270 is assumed to use 10 hours per week of student time. The expected normal pattern of student study each week is

- three hours of lectures
- one hour of laboratory tutorial
- three hours of lecture preparation and revision
- three hours of assignments and test preparation.

Students are expected to attend all lectures and tutorials and to come prepared. This means that you will have previewed the material and done any preliminary examples that have been set.

## Resources

The coursebook containing the lecture notes and some exercises is available from UBS (University Bookshop). A longer guide to Matlab will be on Cecil.

The Student Resource Centre sells the student version of MATLAB. This is about \$98.

## Computing

Each assignment will have some questions that require the use of MATLAB. MATLAB will be available on the Mathematics and Statistics computing laboratory (BCL, B91) in the basement of the Mathematics and Physics building. You log in to the computers in this laboratory using your NetAccount name. There will be demonstrators in the laboratory to assist you with technical problems with MATLAB. The demonstrators will not do your assignment for you. You need not use the computers in the laboratory to do your assignment. If you have MATLAB on your home computer, you can use that. The laboratory will be heavily used during the semester and there may be no computers available when you would like to work on your assignment. Hence it is important to start your assignments early.

## Cecil

This will be used for coursework marks, announcements, and course materials.

## English language assistance

If you require assistance with English there are several services provided by the University of Auckland and by the Department of Mathematics. The main assistance is ELSAC - the English Language Assistance Centre at Web site <http://www.elsac.auckland.ac.nz> This computer-laboratory based service is free and open 7 days a week. Tutors are available to help. Alternatively, there are credit-bearing English language courses (ESOL 100/101/102). The Department of Mathematics offers special tutorial support for Maori and Pasifika students (contact Garry Nathan, Extn 84931), and occasionally runs Mandarin or Cantonese-speaking tutorials (contact Jamie Sneddon, Extn 82121).

## **Collaborating and 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:

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

Generally unacceptable forms of collaboration (“cheating”):

- 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, please discuss it with me.

## **Harassment and complaints**

Complaints about assignment or tutorial marks are best made to your lecturer who is in a position to do something immediately. More general complaints can be taken up by your class representative who should be elected or appointed in the first couple of lectures. You may also approach the Head of Department or the Departmental Manager for Mathematics (extension 88063).

Harassment on any grounds, such as racial, sexual, religious and academic is totally unacceptable. Complaints about harassment are best taken to the University Mediation Service (extension 88905).