THE UNIVERSITY OF SYDNEY
Semester 2, 2011

Information Sheet for **MATH1013 Mathematical Modelling**

Web Sites
It is important that you regularly check both the Junior Mathematics web site

`http://www.maths.usyd.edu.au/u/UG/JM/`

and the MATH1013 web site

`http://www.maths.usyd.edu.au/u/UG/JM/MATH1013`

Lectures
There are 2 different lecture streams. You should attend one stream (that is, two lectures per week), as shown on your personal timetable.

Times	**Location**	**Lecturer**
8 am Thu & Fri	Wallace	Weeks 1–5: Dr F Viera, Carslaw room 527 Weeks 6–13: Dr N Saunders, Carslaw room 807
11 am Thu & Fri	Carslaw 157	A/Prof L Poladian, Carslaw room 713

Lectures run for 13 weeks. The last lecture will therefore be on Friday 28 October.

Consultation times
Lecturers are available for consultation as follows:

- Tuesdays 1-2pm in Carlsaw 713 (weeks 2-13)
- Wednesdays 1-2pm in Carslaw 353 (weeks 2-5)
- Thursdays 1-2pm in Carslaw 353 (weeks 6-13)

Duty tutors will also be available. Check the MATH1013 webpage.

Tutorials
Tutorials (one per week) start in week 2. You should attend the tutorial given on your personal timetable. Attendance at tutorials will be recorded. Your attendance will not be recorded unless you attend the tutorial in which you are enrolled.

The tutorial sheets for a given week will be available on the MATH1013 webpage. **You must take the current week's sheet to your tutorial.** The sheet must be printed from the web.
Solutions to tutorial exercises for week n will usually be posted on the web by the afternoon of the Friday of week n.

Assessment
Your final raw mark for this unit will be calculated as follows:

65%:	Exam at end of semester 2.
30%:	Quiz mark.
5%:	Assignment mark.

Your final raw mark is then scaled to produce your final mark. Marks are scaled so that the distribution of grades is consistent with the quality of the class, and the difficulty of the unit, as required by the University.

Examination
There is one examination of 1.5 hours' duration during the examination period at the end of semester 2. Further information about the exam will be made available at a later date.

Quizzes
There are two quizzes, each worth 15% of your final raw mark. Quizzes are held during tutorials, in

week 6 (beginning 29 August) and **week 12** (beginning 17 October).

You should put those dates in your diary now! You must sit for the quiz during the tutorial in which you are enrolled. Your quiz mark will not be recorded if you sit for the quiz in a tutorial in which you are not enrolled (unless you have made an arrangement with the Mathematics Student Office). If you miss a quiz, then you must go to the Mathematics Student Office as soon as possible afterwards.

Assignments
One assignment will be marked, and will be worth 5% of your final raw mark. The assignment will be due on **Thursday 15 September**. Please see page 26 of the Junior Mathematics Handbook for details relating to the submission of assignments.

Lecture notes
L. Poladian. *Mathematical Modelling*. School of Mathematics and Statistics, University of Sydney, Sydney, NSW, Australia. Available from Kopystop.

Reference books
See the Junior Mathematics and Statistics Handbook.

Any questions?
Before you contact us with any enquiry, please check the FAQ page:

`http://www.maths.usyd.edu.au/u/UG/JM/FAQ.html`

Where to go for help
For administrative matters, go to the **Mathematics Student Office, Carslaw room 520.**
For help with mathematics, see your lecturer, your tutor or a duty tutor. Lecturers guarantee to be available during their indicated office hour, but may well be available at other times as well.
If you are having difficulties with mathematics due to insufficient background, you should go to the Mathematics Learning Centre (Carslaw room 441).

Objectives

The objectives of this course are to:

- Classify, interpret and construct simple mathematical models,
- Compare and discuss the results of applying different models to the same data or situation,
- Understand the limitations of models and mathematical methods,
- Recognise the same information or model when presented in different forms, and convert or transform between equivalent forms,
- Extract qualitative information from a model, including the use of graphical methods,
- Apply simple techniques in unfamiliar situations, including generalising from simple to complex systems,
- Use numerical exploration to understand models, including estimation and approximation.

Outcomes

Students who successfully complete this course should be able to:

- Write down general and particular solutions to simple differential equations and recurrence relations describing models of growth and decay
- Determine the order of a differential equation or recurrence relation,
- Find equilibrium solutions and analyse their stability using both graphical methods and slope conditions
- Recognise and solve separable first-order differential equations
- Use partial fractions and separation of variables to solve certain nonlinear differential equations, including the logistic equation.
- Use a variety of graphical and numerical techniques to locate and count solutions to equations
- Solve equations numerically by fixed-point iteration, including checking if an iteration method is stable.
- Explore sequences numerically, and classify their long-term behaviour
- Determine the general solution to linear second-order equations or simultaneous pairs of first order equations with constant coefficients

Lecture-by-lecture Outline

1. intro to differential equations
2. general and particular solutions (differential equations)
3. equilibrium (steady-state) solutions for differential equations
4. stability of equilibria for differential equations (graphical method)
5. separation of variables
6. simple linear models
7. partial fractions
8. the logistic function
9. Applications of logistic models
10. ... continued
11. intro to difference equations (recurrence relations)
12. general and particular solutions (difference equations)
13. equilibrium (fixed-point) solutions for difference equations
14. stability of fixed points
15. numerical solution of equations
16. fixed-point iteration (Gregory-Dary method)
17. behaviour of logistic map
18. applications of logistic map

    MID SEMESTER BREAK
19. second-order equations
20. the characteristic quadratic (real roots case only first)
21. pairs of first-order differential equations
22. pairs of first-order difference equations
23. trigonometric solutions
24. ...continued
25. review of the unit of study
26. review of past exam