

THE UNIVERSITY OF SYDNEY
Summer School, 2019

Information Sheet for **MATH1013 Mathematical Modelling**

Websites: It is important that you check both the Summer School website and the MATH1013 webpage regularly.

Summer School webpage: <http://www.maths.usyd.edu.au/u/UG/SS>

MATH1013 webpage: <http://www.maths.usyd.edu.au/u/UG/SS/SS1013>

Both sites may be accessed through the Learning Management System (Canvas).

<https://canvas.sydney.edu.au>

Important announcements relating to Summer School will be posted on the Summer School page. On the MATH1013 page you will find online resources (e.g. lecture notes, tutorial sheets, and assessment tasks) and other useful links. Announcements regarding assessment tasks will be made on this page at various times throughout Summer School.

Ed discussion forum: Please post any questions about MATH1013 content on the Ed discussion forum so that other students may either answer your question or benefit from seeing the answer.

<https://edstem.org>

Teaching days: You will have 12 teaching days (consisting of lectures and tutorials) over 5 weeks, as follows. Please check your personal timetable for the location of your tutorial.

Week	Date	Time	Type	Location	Lecturer
1	Tue 8 Jan	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
2	Mon 14 Jan	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
	Tue 15 Jan	2pm–4pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		4pm–5pm	Tutorial		
	Wed 16 Jan	2pm–4pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		4pm–5pm	Tutorial		
3	Mon 21 Jan	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
	Tue 22 Jan	2pm–4pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		4pm–5pm	Tutorial		
4	Tue 29 Jan	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
	Wed 30 Jan	2pm–4pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		4pm–5pm	Tutorial		
5	Mon 4 Feb	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
	Tue 5 Feb	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		
	Wed 6 Feb	2pm–4pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		4pm–5pm	Tutorial		
6	Mon 11 Feb	3pm–5pm	Lecture	Institute Lecture Theatre 1	Collin Zheng
		5pm–6pm	Tutorial		

Consultation times: Consultation times and locations will be posted on the MATH1013 webpage.

Tutorials: Tutorials start in Week 1. You should attend the tutorial shown 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.

Tutorial and exercise sheets: The question sheets for a given week will be available on the MATH1013 webpage. Solutions to tutorial exercises for week n will be posted on the web by the afternoon of the Friday of week n .

Textbook: You are recommended to buy a booklet titled *Mathematical Modelling* by Leon Poladian, available from Kopystop (55 Mountain St. near Broadway Shopping Centre). These printed notes will be of great supplement to the physical lectures.

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

- 50%: Exam during the Summer School exam period.
- 30%: Quizzes (2 in total worth 15% each, using the better-mark principle).
- 20%: Lecture pop quizzes (4 in total worth 5% each)
- 0%: (Optional) homework (5 in total, one per week)

The *better mark principle* means that for each quiz, the quiz counts if and only if it is better than or equal to your exam mark. If your quiz mark is less than your exam mark, the exam mark will be used for that portion of your assessment instead. For example, if your quiz 1 mark is better than your exam mark while your quiz 2 mark is worse than your exam mark, then the exam will count for 65%, and quiz 1 will count for 15%.

Final grades are returned within one of the following bands:

High Distinction (HD), 85–100: representing complete or close to complete mastery of the material; **Distinction (D), 75–84:** representing excellence, but substantially less than complete mastery; **Credit (CR), 65–74:** representing a creditable performance that goes beyond routine knowledge and understanding, but less than excellence; **Pass (P), 50–64:** representing at least routine knowledge and understanding over a spectrum of topics and important ideas and concepts in the course.

A student with a passing or higher grade should be well prepared to undertake further studies in mathematics which are dependent on this unit of study. A student achieving a distinction or higher grade should consider enrolling in advanced units in second semester.

Examination: There is one examination with 10 minutes of reading time and 90 minutes of writing time. It will be held at 1:50pm on Friday 15 February in a room TBA. Further information about the exam will be made available at a later date on the website.

Quizzes

There are two quizzes, each worth 15% of your final raw mark and are **held in TUTORIALS**.

Lecture Pop Quizzes

To encourage students to actively attend lectures, four American-style “pop quizzes” worth a combined total of 20% will be held in lectures. Each pop quiz can potentially be held in ANY lecture. The questions will be fairly routine and this represents a relatively easy way to obtain a good proportion of marks just by making sure you turn up to class!

Better Mark Principle

Your quizzes and lecture pop quizzes are calculated using the *better mark principle*, which means that for each quiz, the quiz counts if and only if it is better than or equal to your exam mark. (Yay!) So if your quiz mark ended up being less than your exam mark, then the exam mark will be used for that portion of your assessment instead.

For instance, if you went better in the exam than, say, Quiz 1, then your exam mark will count for 65% (50% + 15%).

This sympathetic policy exists to cut you some slack because we all have bad days or days where you cannot make class.

Missed quizzes and pop quizzes are automatically deferred to the bettermark principle—there will be no opportunities for make-up sessions. For example, if you miss Quiz 2 due to an alien abduction, your exam will automatically be worth $50\% + 15\% = 65\%$. You do not need to email me if you cannot make a quiz.

Homework

In addition to the quizzes and pop quizzes held in lectures, there will also be regular and optional homework assignments which you may submit to me each week. These represent an excellent way to consolidate your knowledge of the material covered in lectures and tutorials and I would highly encourage all students to attempt them. I will then do my best to have a look at your submission and provide you with feedback. There are a total of 5 homework assignments.

Assessment and feedback schedule:

Task	Deadline/date	Feedback	
Quiz 1	Mon 21 Jan (Week 3)	Mon 28 Jan (Week 4)	
Quiz 2	Wed 6 Feb (Week 5)	Mon 11 Feb (Week 6)	

* Extensions for assignments are only possible for students registered with Disability Services or applying for Special Consideration or Special Arrangements.

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 *Student Services Office, Carslaw 520*. For help with mathematics, see your lecturer, your tutor, a duty tutor, or use the Ed discussion forum (<https://edstem.org>). Lecturers guarantee to be available during their indicated office hours, but may be available at other times as well. If you are having difficulties with mathematics due to insufficient background, you may seek help from the *Mathematics Learning Centre*. You may also email questions about the subject to MATH1013@sydney.edu.au. Ensure that any emails that you send to this address contain your name and SID, because anonymous emails will be ignored.

Graduate qualities: The graduate qualities are the qualities and skills that all University of Sydney graduates must demonstrate on successful completion of an award course. As a future Sydney graduate, the set of qualities have been designed to equip you for the contemporary world. For more information go to sydney.edu.au/students/graduate-qualities.

GQ1 Depth of disciplinary expertise

GQ2 Critical thinking and problem solving

GQ3 Communication (oral and written)

GQ4 Information & digital literacy

GQ5 Inventiveness

GQ6 Cultural competence

GQ7 Interdisciplinary effectiveness

GQ8 Integrated professional, ethical and personal identity

GQ9 Influence

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.

In addition, this unit provides students with a solid foundation for further studies in mathematics and/or other scientific disciplines.

Outcomes: Students who successfully complete this course should be able to:

- Write down general and particular solutions to simple differential equations and recurrence relations that describe 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.

Proposed week-by-week outline:

PART I: Intro to first-order Differential Equations

- **Week 1 Tues:** Introduction to differential equations (DE).
- **Week 2 Mon:** Equilibria (steady-state solutions) and stability for DEs.
- **Week 2 Tues:** Separation of variables. Simple linear models.
- **Week 2 Wed:** Partial fractions. A simple epidemic model.
- **Week 3 Mon:** Applications of Logistic Models.

PART II: Difference Equations/Recurrence Relations

- **Week 3 Tues:** Introduction to difference equations a.k.a. recurrence relations (RR).
- **Week 4 Tues:** Equilibria and stability for RRs.
- **Week 4 Wed:** Numerical solution of equations. Fixed-point iteration (Gregory-Dary method).
- **Week 5 Mon:** Behaviour and applications of the logistic map.

PART III: Second-order models and pairs of first-order equations

- **Week 5 Tues:** Second-order equations (characteristic equation with distinct real roots)
- **Week 5 Wed:** Interactions—pairs of first-order differential and recurrence relations.
- **Week 6 Mon:** Trigonometric solutions of second-order DEs. Revision.

ADDITIONAL INFORMATION

Attendance: Unless otherwise indicated, students are expected to attend a minimum of 80% of timetabled activities for a unit of study, unless granted exemption by the Associate Dean.

For some units of study the minimum attendance requirement, as specified in the relevant table of units or the unit of study outline, may be greater than 80%.

The Associate Dean may determine that a student has failed a unit of study because of inadequate attendance.

Further details are available from the Science Undergraduate Handbook 2018: http://sydney.edu.au/handbooks/science/coursework/faculty_resolutions.shtml and the Science Postgraduate Handbook 2018: http://sydney.edu.au/handbooks/science_PG.

Online components: This unit of study requires regular use of the University's Learning Management System (LMS), Canvas. Internet access is required to use the LMS.

Assessment submission: Assessment tasks must be submitted by the due date. Submission will be online through the LMS unless instructed otherwise.

Compliance statement: All students must submit a signed statement of compliance with each piece of work submitted to the University for assessment, presentation or publication. A statement of compliance certifies that no part of the work constitutes a breach of the Academic Honesty in Coursework Policy 2015: <https://sydney.edu.au/policies/showdoc.aspx?recnum=PDO2012/254&RendNum=0>.

This will be completed as part of the Turnitin assignment submission.

Educational integrity: While the University is aware that the vast majority of students and staff act ethically and honestly, it is opposed to and will not tolerate academic dishonesty or plagiarism and will treat all allegations of dishonesty seriously.

All written assignments submitted in this unit of study will be submitted to the similarity detecting software program known as Turnitin. Turnitin searches for matches between text in your written assessment task and text sourced from the Internet, published works and assignments that have previously been submitted to Turnitin. If such matches indicate evidence of plagiarism to your teacher, they are required to report your work for further investigation.

Plagiarism is defined as presenting another persons work as ones own by presenting, copying or reproducing it without appropriate acknowledgement of the source.

Plagiarism includes presenting work for assessment, publication, or otherwise, that includes:

- a. phrases, clauses, sentences, paragraphs or longer extracts from published or unpublished work (including from the internet) without appropriate acknowledgement of the source; or
- b. the work of another person, without appropriate acknowledgement of the source and in a way that exceeds the boundaries of legitimate co-operation.

Further information on academic honesty and the resources available to all students can be found on the Academic Integrity page of the current students website: sydney.edu.au/educational-integrity.

Academic Honesty Education Module (AHM): All students commencing their study at the University of Sydney are required to complete the Academic Honesty Education Module. You will find the AHM in your Learning Management System.

Special consideration: In the event of serious illness or misadventure which affects your preparation or performance in an assessment task, you may be eligible for Special Consideration. Further information is available at: <https://sydney.edu.au/students/special-consideration-and-arrangements.html>. You should *not* submit an application for Special Consideration or Special Arrangements for this unit of study

- if you are absent from a tutorial and there is no assessment associated with the missed tutorial, or
- if you miss a quiz, since the better mark principle applies.

The assessment category for the assignments is "Submitted Work".

Student feedback: The Unit of Study Survey. At the completion of each Unit of Study, students are asked via email to complete an online survey to provide feedback on their experiences in that Unit of Study. This feedback is invaluable when reviewing curriculum design and implementation styles.

University Work Health and Safety Policy: We are governed by the Work Health and Safety Act 2011, Work Health and Safety Regulation 2011 and Codes of Practice. Penalties for non-compliance have increased. Everyone has a responsibility for health and safety at work. The University's Work Health and Safety policy explains the responsibilities and expectations of workers and others, and the procedures for managing WHS risks associated with University activities.

General Laboratory Safety Rules

- No eating or drinking is allowed in any laboratory under any circumstances
- A laboratory coat and closed-toe shoes are mandatory
- Follow safety instructions in your manual and posted in laboratories
- In case of fire, follow instructions posted outside the laboratory door
- First aid kits, eye wash and fire extinguishers are located in or immediately outside each laboratory

As a precautionary measure, it is recommended that you have a current tetanus immunisation. This can be obtained from University Health Service (<http://www.unihealth.usyd.edu.au/>).

For more details please refer to Emergencies and safety on campus: <https://sydney.edu.au/students/emergencies-and-safety-on-campus.html>

Student support services:

A guide for new students:

<https://sydney.edu.au/students/browse.html?category=new-students&topic=getting-started>

Counselling and mental health support:

<https://sydney.edu.au/students/counselling-and-mental-health-support.html>

Disability Support:

<https://sydney.edu.au/students/disability-support.html>

International Student Support:

<https://sydney.edu.au/students/support-for-international-students.html>

Learning Services / Study Skills Support:

<https://sydney.edu.au/students/learning-services.html>

Student IT and online learning:

<https://sydney.edu.au/students/browse.html?category=student-it-and-online-learning&topic=online-learning>

Academic Writing:

<https://sydney.edu.au/students/writing.html>