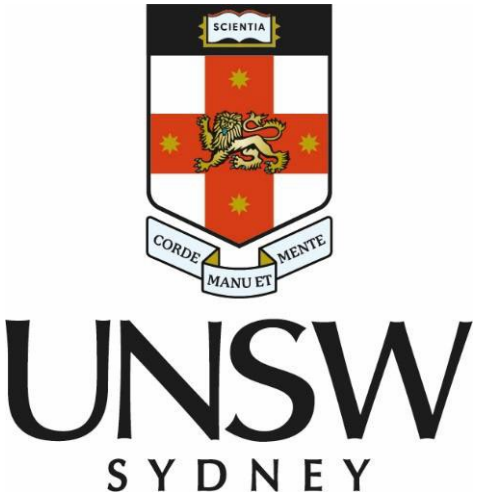

UNSW SCIENCE

School of Maths and Statistics

Course outline

MATH2089

Numerical Methods and Statistics

Term 1, 2023

Staff

Position	Name	Email	Room
Lecturer-in-charge (Numerical Methods)	Prof Frances Kuo	f.kuo@unsw.edu.au	RC-3061
Lecturer-in-charge (Statistics)	Prof David Warton	david.warton@unsw.edu.au	RC-2052

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times.
Timetable weblink: https://timetable.unsw.edu.au/2023/MATH2089.html

Administrative Contacts

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to “Current Students” and either Undergraduate and/or Postgraduate”, Course Homepage” for information on all course offerings,

The “Student Notice Board” can be located by going to the “Current Students” page; Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is: https://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email Undergraduate ug.mathsstats@unsw.edu.au

By phone: 9385 7011 or 9385 7053

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please state your student number in all emails.**

Course Information

Assumed knowledge / Pre-Requisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

Exclusions: BEES2041, CVEN2002, CVEN2702, MATH2099, MATH2301, MATH2801, MATH2859, MATH2901, ECON3209

Course Description

This course gives an introduction to numerical methods and statistics essential in a wide range of engineering disciplines.

Numerical methods: Computing with real numbers. Numerical differentiation, integration, interpolation and curve fitting (regression analysis). Solution of linear and nonlinear algebraic equations. Matrix operations and applications to solution of systems of linear equations, elimination and tri-diagonal matrix algorithms. Introduction to numerical solution of ordinary and partial differential equations.

Statistics: Exploratory data analysis. Probability and distribution theory including the Binomial, Poisson and Normal distributions. Large sample theory including the Central Limit Theorem. Elements of statistical inference including estimation, confidence intervals and hypothesis testing. One sample and two-sample t-tests. Simple linear regression and analysis of variance.

In each component, applications will be drawn from a variety of engineering disciplines. Matlab will be used extensively as a practical tool for both numerical and statistical computations and to illustrate theoretical concepts.

Assessment and Deadlines

Assessment	**Week**	**Weighting %**	
Numerical Methods			
Online quizzes (8)	Weeks 2-5 and 7-10	10	1.25% each for 8 modules
Numerical Methods Test 1	Week 5	5	
Numerical Methods Test 2	Week 9	5	
Final Exam	Exam period	30	
	Total	**50**	
Statistics			
Online lectures & quizzes (10)	Weeks 2-5 and 7-10	10	1% each for 10 modules
Midterm Test	Week 7	10	
Final Exam	Exam Period	30	
	Total	**50**	
	Grand Total	**100**	

To pass this course, you must achieve at least 50% in your final combined mark for the course. Additionally, you must achieve at least 40% in Numerical Methods and 40% in Statistics, that is, a minimum of 20/50 in each component.

Late Submission of Assessment Tasks

Not applicable.

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are

approximate. The course content is ultimately defined by the material covered in lectures.

Numerical Method

Weeks	Topic	Reading (if applicable)
1	Numerical Computing	Refer to Moodle page
2	Linear Systems	Refer to Moodle page
3	Linear Systems	Refer to Moodle page
4	Least Squares and Polynomial Interpolation	Refer to Moodle page
5	Nonlinear Equations	Refer to Moodle page
7	Numerical Differentiation and Integration	Refer to Moodle page
8	Ordinary Differential Equations	Refer to Moodle page
9	Partial Differential Equations	Refer to Moodle page
10	Partial Differential Equations and Review	Refer to Moodle page

Statistics

Weeks	Topic	Reading (if applicable)
1	Probability (revision); Descriptive statistics	Lecture notes
2	Random variables	Lecture notes
3	Special random variables	Lecture notes
4	Sampling distributions and the Central Limit Theorem	Lecture notes
5	Confidence intervals for means and proportions	Lecture notes
7	Hypothesis testing	Lecture notes
8	Inference concerning differences in means	Lecture notes
9	Regression analysis	Lecture notes
10	Analysis of variance	Lecture notes

Textbooks

Numerical Methods

Recommended textbook:

S. S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice Hall, Upper Saddle River, N.J., 2002. This book is available for purchase in the UNSW bookshop and is also in the UNSW library High Use Collection.

Further resources on MatLab:

1. J. H. Mathews and K. D. Fink, Numerical methods using MATLAB, Upper Saddle River, N.J: Pearson, 2004.
2. C. Moler, Numerical Computing with Matlab, SIAM, 2004, http://www.mathworks.com/moler/
3. Gilat, MATLAB: an introduction with applications, New York; Chichester: Wiley, 2005.

Statistics

Recommended Text:

J. Devore and N. Farnum, Applied Statistics for Engineers and Scientists, 2nd Edition, 2005 Duxbury Press, Thomson Publishers (or 3rd edition of this book).

Additional Reading:

Any text with "Statistics" and "Engineers" in its title. A quite comprehensive reference is:

D. Montgomery and G. Runger, Applied Statistics and Probability for Engineers, 5th Edition, 2011, Wiley (or a previous edition of this book)

Course Learning Outcomes (CLO)

CLO1 Identify risks associated with floating point computations

CLO2 Demonstrate a basic knowledge of the techniques for accurate and efficient solution of models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations

CLO3 Apply these techniques to practical problems in Engineering

CLO4 Use Matlab for the implementation and application of numerical methods and the visualization of results

CLO5 Apply various graphical and data analysis methods for summarizing and understanding data

CLO6 Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts

CLO7 Apply Matlab for graphical and statistical analysis

Moodle

Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc.

https://moodle.telt.unsw.edu.au

Computing lab

The main computing laboratory is Room G012 of the Red Centre. You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and

then going down the stairs to the Ground Level. A second smaller lab is Room M020, on the mezzanine level of the Red Centre.

For more information, including opening hours, see the computing facilities webpage: https://www.unsw.edu.au/science/our-schools/maths/student-life-resources/student-services/computing-information/computing-facilities

Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing assessments on time.

School of Mathematics and Statistics and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site.

Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the Maths Stats web site starting at:

https://www.maths.unsw.edu.au/currentstudents/assessment-policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

*The **UNSW Student Code*** provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at: https://student.unsw.edu.au/plagiarism

An online Module "Working with Academic Integrity" (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you've ever made.

Plagiarism

Plagiarism is presenting another person's work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

Equitable Learning Services (ELS)

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
- who are primary carers
- from low SES backgrounds
- of diverse genders, sexes and sexualities
- from refugee and refugee-like backgrounds
- from rural and remote backgrounds
- who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS.

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

Academic Skills Support and the Learning Centre

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:

http://www.lc.unsw.edu.au/services-programs

Applications for Special Consideration for Missed Assessment

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.

https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The School will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test or paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

For Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.

https://student.unsw.edu.au/exam-dates

If you believe your application for Special Consideration has not been processed, you should email

specialconsideration@unsw.edu.au immediately for advice.

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey *myExperience*, which allows students to evaluate their learning experiences in an anonymous way. *myExperience* survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.