UNSW Course Outline

MATH2089 Numerical Methods and Statistics - 2024

Published on the 25 Aug 2024

General Course Information

Course Code : MATH2089
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Science
Academic Unit : School of Mathematics & Statistics
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

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 or Python will be used as a practical tool for both numerical and statistical computations and to illustrate theoretical concepts that are introduced during lectures and tutorials.

Course Aims

The aim of this course is to develop core numerical and statistical skills needed for a career in engineering. You will develop skills in numerical and statistical methods for making decisions in engineering contexts, with an emphasis on computational tools for solving different types of equations (involving linear and non-linear terms, or derivatives) and tools for making sense of data. The course builds on your knowledge from foundational mathematics courses.

Relationship to Other Courses

Prerequisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Identify risks associated with floating point computations.
CLO2 : Apply numerical techniques to find accurate and efficient solutions for models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.
CLO3 : Apply numerical techniques to practical problems in Engineering.
CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.
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.

Course Learning Outcomes	Assessment Item
CLO1 : Identify risks associated with floating point computations.	• Online Quizzes • Numerics mid term test • Final Exam
CLO2 : Apply numerical techniques to find accurate and efficient solutions for models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.	• Online Quizzes • Numerics mid term test • Final Exam
CLO3 : Apply numerical techniques to practical problems in Engineering.	• Online Quizzes • Numerics mid term test • Final Exam
CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.	• Stats Mid Term Test • Online Quizzes • Numerics mid term test • Final Exam
CLO5 : Apply various graphical and data analysis methods for summarizing and understanding data.	• Stats Mid Term Test • Online Quizzes • Final Exam
CLO6 : Apply various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts.	• Stats Mid Term Test • Online Quizzes • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Mobius

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Online Quizzes Assessment Format: Individual	20%	Start Date: Not Applicable Due Date: Weekly from Week 2
Stats Mid Term Test Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 7 EXM
Numerics mid term test Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Two NM tests in Week 5 EXM and Week 9 EXM
Final Exam Assessment Format: Individual	60%	Start Date: Not Applicable Due Date: During the exam period

Assessment Details

Online Quizzes

Assessment Overview

Statistics component:

Each week, you will be introduced to core ideas via online lecture modules and asked to complete associated exercises prior to your first statistics class for the week. A revision quiz is then due after class to check your understanding of the module content.

Numerical methods component:

Each week (from Week 2 onward) you will do online quizzes to revise your understanding of the material that has been introduced.

The 8 total quizzes are administered on Möbius and marked automatically, so you receive immediate feedback on performance. The quizzes are due each week in Weeks 2-5 and 7-10, students will have unlimited attempts with the highest mark counting, and they will be available at least two weeks before the due date. Each quiz is weighted equally.

Course Learning Outcomes

- CLO1 : Identify risks associated with floating point computations.
- CLO2 : Apply numerical techniques to find accurate and efficient solutions for models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.
- CLO3 : Apply numerical techniques to practical problems in Engineering.
- CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.
- 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.

Detailed Assessment Description

Statistics online quizzes contribute 10% to your final grade.

Numerical methods online quizzes contribute 10% to your final grade.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate

information or answers.
For more information on Generative AI and permitted use please see here.

Stats Mid Term Test

Assessment Overview

The statistics mid-term test will be held in Week 7 and administered via Möbius. You will be expected to apply techniques learnt in weeks 1-5 for descriptive statistics, calculating probabilities, studying the performance of estimators and making inferences about a sample mean.

Course Learning Outcomes

- CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.
- 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.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Numerics mid term test

Assessment Overview

You will complete two Numerical methods tests, worth 5% each.

Test 1 in Week 5 is designed to assess your knowledge of Topics 1-3, which are covered in lectures in weeks 1-4.
Test 2 in Week 9 is designed to assess your knowledge of Topics 4-6, which are covered in lectures in weeks 4-8. The tests will be held on the Möbius platform in the computing labs.

You will be provided with practice questions and answers beforehand. You will be provided with the correct answers after the tests.

Course Learning Outcomes

- CLO1 : Identify risks associated with floating point computations.
- CLO2 : Apply numerical techniques to find accurate and efficient solutions for models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.
- CLO3 : Apply numerical techniques to practical problems in Engineering.
- CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Final Exam

Assessment Overview

You will complete a 2 hour final exam held during the formal university examination period. It will be equally weighted on statistics numerical methods, and cover all course content delivered across the term. This will be administered via Möbius, in order to assess mastery of the material and ability to apply core numerical methods and statistical techniques to applied problems.

Feedback will be available through inquiry with the course convenor.

Course Learning Outcomes

- CLO1 : Identify risks associated with floating point computations.
- CLO2 : Apply numerical techniques to find accurate and efficient solutions for models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.
- CLO3 : Apply numerical techniques to practical problems in Engineering.
- CLO4 : Use MATLAB or Python to apply numerical and statistical methods and for graphical analysis.
- 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.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Grading Basis

Standard

Requirements to pass course

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**. If you do not get at least 40% in each component, you will receive the grade UF* - Unsatisfactory Fail, even though your overall course mark may be greater than 50%.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Numerical Methods: Numerical Computing Statistics: Probability (revision); Descriptive Statistics
Week 2 : 16 September - 22 September	Lecture	Numerical Methods: Linear Systems Statistics: Random Variables
Week 3 : 23 September - 29 September	Lecture	Numerical Methods: Linear Systems Statistics: Special Random Variables
Week 4 : 30 September - 6 October	Lecture	Numerical Methods: Least Squares and Polynomial Interpolation Statistics: Sampling Distributions and the Central Limit Theorem
Week 5 : 7 October - 13 October	Lecture	Numerical Methods: Nonlinear Equations Statistics: Confidence Intervals for Means and Proportions
Week 7 : 21 October - 27 October	Lecture	Numerical Methods: Numerical Differentiation and Integration Statistics: Hypothesis Testing
Week 8 : 28 October - 3 November	Lecture	Numerical Methods: Ordinary Differential Equations Statistics: Inference Concerning Differences in Means
Week 9 : 4 November - 10 November	Lecture	Numerical Methods: Partial Differential Equations Statistics: Regression Analysis
Week 10 : 11 November - 17 November	Lecture	Numerical Methods: Partial Differential Equations and Review Statistics: Analysis of Variance

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Resources

Recommended Resources

Recommended textbook for Numerical Methods:

S. S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice Hall, Upper Saddle River, N.J., 2002.

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.

Recommended textbook for Statistics:

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 for Statistics:

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)

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
	Frances Kuo					Yes	Yes
	Eka Shinjikashvili					Yes	No

Other Useful Information

Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe, harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the UNSW Student Code of Conduct Website.

Academic Honesty and Plagarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.
Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage. At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.
Further information about academic integrity, plagiarism and the use of AI in assessments can be located at:

- The Current Students site,
- The ELISE training site, and
- The Use of AI for assessments site.

The Student Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct

Submission of Assessment Tasks

Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

Special Consideration

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: https://student.unsw.edu.au/special-consideration

Important note: UNSW has a "fit to sit/submit" rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

Faculty-specific Information

Additional support for students

- The Current Students Gateway
- Student Support
- Academic Skills and Support
- Student Wellbeing, Health and Safety
- Equitable Learning Services
- UNSW IT Service Centre
- Science EDI Student Initiatives, Offerings and Guidelines

School Contact Information

Please visit the School of Mathematics and Statistics website for a range of information.

For information on Courses, please go to “Student life & resources” and either Undergraduate and/or Postgraduate and respective "Undergraduate courses" and "Postgraduate courses" for information on all course offerings.

All school policies, forms and help for students can be located by going to the "Student Services" within “Student life & resources” page. We also post notices in "Student noticeboard" for your information. Please familiarise yourself with the information found in these locations. If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

Undergraduate

E: ug.mathsstats@unsw.edu.au

P: 9385 7011 or 9385 7053

Postgraduate

E: pg.mathsstats@unsw.edu.au

P: 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 use your UNSW student email and state your student number in all emails to us.**