UNSW Course Outline

ZPEM1303 Engineering Mathematics 1A - 2024

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General Course Information

Course Code : ZPEM1303
Year : 2024
Term : Semester 1
Teaching Period : Z1
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : UC Science
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Engineering Maths 1A is an introduction to the basics of Calculus and Linear Algebra, and to mathematical modelling or applications in both cases. It emphasises the understanding of mathematical concepts and developing an appreciation for mathematical thinking. The course is

designed to provide students from diverse backgrounds with the appropriate mathematical foundations for studying Engineering. The following topics are covered:

- **Calculus** - Concept of a function and limits. Calculus of functions of a single variable: differentiation; optimisation; integration; and Taylor series.
- **Algebra** - Geometrical and algebraic description of vectors and their properties; linear systems; matrices and their properties; applications of matrices to applied problems; eigenvalue problems; introduction to complex numbers.

Course Aims

The aim of this course is to provide students from diverse backgrounds with the appropriate foundations for further studies in Mathematics and Engineering.

Relationship to Other Courses

ZPEM1303 is a core part of the various Engineering programs. ZPEM1303 naturally connects with ZPEM1304 Engineering Mathematics 1B and other Mathematics and Physics courses within the Engineering programs: ZPEM1503, ZPEM1504, ZPEM2309, and ZPEM2310.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Represent functions numerically, graphically and algebraically, and be able to interpret them in applications. Understand the concept of a limit and be able to calculate limits algebraically.
CLO2 : Explain the meaning of the derivative, and calculate it algebraically from first principles; differentiate standard functions and interpret their derivatives in applications.
CLO3 : Explain the meaning of the integral, and calculate it algebraically; Integrate standard functions and interpret their integral in applications.
CLO4 : Understand the basic concept of the Taylor series of a function and understand how it applies in applications.
CLO5 : Understand the geometric and algebraic representations of vectors, and use vectors in a variety of applications.
CLO6 : Apply linear systems of equations to various applications and solve them.
CLO7 : Represent a linear system of equation in terms of matrices, and use matrix properties to solve the equations.
CLO8 : Define and solve eigenvalue problems.
CLO9 : Represent complex numbers in both algebraic and geometric forms, and manipulate them.

Course Learning Outcomes	Assessment Item
CLO1 : Represent functions numerically, graphically and algebraically, and be able to interpret them in applications. Understand the concept of a limit and be able to calculate limits algebraically.	• Initial Class Test • Class Test 2 • Exam
CLO2 : Explain the meaning of the derivative, and calculate it algebraically from first principles; differentiate standard functions and interpret their derivatives in applications.	• Initial Class Test • Class Test 2 • Exam
CLO3 : Explain the meaning of the integral, and calculate it algebraically; Integrate standard functions and interpret their integral in applications.	• Class Test 2 • Exam
CLO4 : Understand the basic concept of the Taylor series of a function and understand how it applies in applications.	• Exam
CLO5 : Understand the geometric and algebraic representations of vectors, and use vectors in a variety of applications.	• Class Test 1 • Initial Class Test • Exam
CLO6 : Apply linear systems of equations to various applications and solve them.	• Class Test 1 • Initial Class Test • Exam
CLO7 : Represent a linear system of equation in terms of matrices, and use matrix properties to solve the equations.	• Class Test 1 • Exam
CLO8 : Define and solve eigenvalue problems.	• Exam
CLO9 : Represent complex numbers in both algebraic and geometric forms, and manipulate them.	• Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Initial Class Test Assessment Format: Individual	10%	Start Date: 22/03/2024 10:00 AM Due Date: Not Applicable
Class Test 1 Assessment Format: Individual	20%	Start Date: 01/05/2024 11:00 AM Due Date: Not Applicable
Class Test 2 Assessment Format: Individual	20%	Start Date: 03/05/2024 10:00 AM Due Date: Not Applicable
Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Initial Class Test

Assessment Overview

Early class test covering both algebra and calculus content.

Course Learning Outcomes

- CLO1 : Represent functions numerically, graphically and algebraically, and be able to interpret them in applications. Understand the concept of a limit and be able to calculate limits algebraically.
- CLO2 : Explain the meaning of the derivative, and calculate it algebraically from first principles; differentiate standard functions and interpret their derivatives in applications.
- CLO5 : Understand the geometric and algebraic representations of vectors, and use vectors in a variety of applications.
- CLO6 : Apply linear systems of equations to various applications and solve them.

Detailed Assessment Description

The initial class test assesses content from both linear algebra and calculus components from the preceding 3-4 weeks.

Assessment Length

50 minutes

Submission notes

Handwritten test

Assignment submission Turnitin type

Not Applicable

Class Test 1

Assessment Overview

Class test covering the algebra content from the preceding 5-6 weeks.

Course Learning Outcomes

- CLO5 : Understand the geometric and algebraic representations of vectors, and use vectors in a variety of applications.
- CLO6 : Apply linear systems of equations to various applications and solve them.
- CLO7 : Represent a linear system of equation in terms of matrices, and use matrix properties to solve the equations.

Detailed Assessment Description

The first class test is assessing solely material from the linear algebra component of ZPEM1303.

This includes content assessed during the "Initial Class Test".

Assessment Length

50 minutes

Submission notes

Handwritten test

Assignment submission Turnitin type

Not Applicable

Class Test 2

Assessment Overview

Class test covering calculus content from the preceding 5-6 weeks.

Course Learning Outcomes

- CLO1 : Represent functions numerically, graphically and algebraically, and be able to interpret them in applications. Understand the concept of a limit and be able to calculate limits algebraically.
- CLO2 : Explain the meaning of the derivative, and calculate it algebraically from first principles; differentiate standard functions and interpret their derivatives in applications.
- CLO3 : Explain the meaning of the integral, and calculate it algebraically; Integrate standard functions and interpret their integral in applications.

Detailed Assessment Description

The second class test is assessing solely material from the calculus component of ZPEM1303.

This includes content assessed during the "Initial Class Test".

Assessment Length

50 minutes

Submission notes

Handwritten test

Assignment submission Turnitin type

Not Applicable

Exam

Assessment Overview

Final summative assessment item

Course Learning Outcomes

- CLO1 : Represent functions numerically, graphically and algebraically, and be able to interpret them in applications. Understand the concept of a limit and be able to calculate limits algebraically.
- CLO2 : Explain the meaning of the derivative, and calculate it algebraically from first principles; differentiate standard functions and interpret their derivatives in applications.
- CLO3 : Explain the meaning of the integral, and calculate it algebraically; Integrate standard functions and interpret their integral in applications.
- CLO4 : Understand the basic concept of the Taylor series of a function and understand how it applies in applications.
- CLO5 : Understand the geometric and algebraic representations of vectors, and use vectors in a variety of applications.
- CLO6 : Apply linear systems of equations to various applications and solve them.
- CLO7 : Represent a linear system of equation in terms of matrices, and use matrix properties to solve the equations.
- CLO8 : Define and solve eigenvalue problems.
- CLO9 : Represent complex numbers in both algebraic and geometric forms, and manipulate them.

Detailed Assessment Description

Material from both linear algebra and calculus components are assessed in the exam. This may include any material already assessed in earlier class tests as well as content not yet assessed.

Assessment Length

3 hours

Submission notes

Handwritten test.

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Use of AI in Assessments

NO ASSISTANCE

It is prohibited to use any software or service to search for or generate information or answers. If

its use is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

Grading Basis

Standard

Requirements to pass course

Achieve a composite mark of at least 50 out of 100.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	• Linear Algebra Lecture 1 - Introduction Lecture 2 - Linear Systems I • Calculus Introduction to functions
Week 2 : 4 March - 8 March	Lecture	• Linear Algebra Lecture 3 - Linear Systems II Lecture 4 - Linear Systems III • Calculus Introduction to functions
Week 3 : 11 March - 15 March	Lecture	• Linear Algebra Canberra Day -- Monday, 11 March Lecture 5 - Vectors I • Calculus Elementary functions
Week 4 : 18 March - 22 March	Assessment	Initial Class Test Friday, 22 March at 1000-1050.
	Lecture	• Linear Algebra Lecture 6 - Vectors II Lecture 7 - Vectors III • Calculus Inverse Functions I
Week 5 : 25 March - 29 March	Lecture	• Linear Algebra Lecture 8 - Vectors IV Lecture 9 - Vectors V • Calculus Lecture 8 - Inverse Functions II Good Friday, 29 March
Week 6 : 1 April - 5 April	Lecture	• Linear Algebra Easter Monday, 1 April Lecture 10 - Lines • Calculus Lectures 9 and 10 - Introduction to Differentation
Week 7 : 22 April - 26 April	Lecture	• Linear Algebra Lecture 11 - TBA Military Training Day, 24 April • Calculus ANZAC Day, 25 April Lecture 11 - TBA
Week 8 : 29 April - 3 May	Lecture	• Linear Algebra Lecture 12 - Planes Class Test 1, 1 May • Calculus Lecture 12 - Linearity of Differentiation Class Test 2, 3 May
	Assessment	Class Test 1 May 1 at 1100-1150
	Assessment	Class Test 2 May 3 at 1000-1050
	Assessment	Class Test 1 May 1 at 1000-1050
Week 9 : 6 May - 10 May	Lecture	• Linear Algebra Lecture 13 - Linear Independence Lecture 14 - Matrices I • Calculus Lecture 13 - Properties of the derivative Military Training Day, 10 May
Week 10 : 13 May - 17 May	Lecture	• Linear Algebra Lecture 15 - Matrices II Lecture 16 - Matrices III • Calculus Lecture 14 - Extremal Problems Lecture 15 - Introduction to Integration
Week 11 : 20 May - 24 May	Lecture	• Linear Algebra Lecture 17 - Determinants Lecture 18 - Eigenproblems I • Calculus Lecture 16 - Riemann Sums Lecture 17 - Integration Properties
Week 12 : 27 May - 31 May	Lecture	• Linear Algebra Lecture 19 - Elgenproblems II Note: Monday timetable on Tuesday 28 May Lecture 20 - Complex Numbers I • Calculus Lecture 18 - Integration techniques I Lecture 19 - Integration techniques II
Week 13 : 3 June - 7 June	Lecture	• Linear Algebra Lecture 21 - Complex Numbers II Lecture 22 - Complex Numbers III • Calculus Lecture 20 - Integration techniques III Lecture 21 - Integration techniques IV

Attendance Requirements

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

General Schedule Information

There are two components of ZPEM1303 Engineering Mathematics 1A:

- Linear Algebra -- delivered on Mondays & Wednesdays
- Calculus -- delivered on Thursdays & Fridays

Students have two tutorials per week: one will be for algebra, the other for calculus.

Course Resources

Prescribed Resources

We are using the open textbook *"Matrix Theory & Linear Algebra"* by Peter Selinger for the linear algebra component of ZPEM1303. A PDF of the text is available on the course Moodle page.

From this text we will work through the material presented in:

- *Systems of linear equations,* Chapter 1, sections 1-8
- *Vectors, Lines & Planes ,* Chapter 2 & 3
- *Matrices,* Chapter 4, sections 1-7
- *Linear Independence,* Chapter 5, sections 1-2
- *Determinants, Eigenproblems*, Chapter 7 & 8
- *Complex number*, Appendix A

Additional notes will be made available on Moodle as required.

Course notes for calculus are available on Moodle.

Recommended Resources

- Barry, S & Davis, S, Essential Mathematical Skills, 2nd edition, UNSW Press.
- Stuart's “Calculus”: any edition will do. This can be obtained in print, from the library, or online.

Additional Costs

Nil.

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is

by
listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Isaac To wers		Room 132, Building 26, Science South, UNSW Canberra	5114 5050	Students can make appointments, via email, to meet during normal working hours - Monday to Friday.	No	Yes
Lecturer	Timothy Trudgian		Room 104, Building 26, Science South, UNSW Canberra	5114 5026	Students can make appointments, via email, to meet during normal working hours - Monday to Friday.	No	No

Other Useful Information

Academic Information

Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitible Learning Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: https://www.student.unsw.edu.au/equitable-learning

Academic Honesty and Plagarism

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. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: Student Code of Conduct (unsw.edu.au)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Submission of Assessment Tasks

Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: https://www.student.unsw.edu.au/special/consideration/guide

Or apply for special consideration through your MyUNSW portal.

Late Submission of assessment tasks (other than examinations)

UNSW has a standard late submission penalty of:

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

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

Electronic submission of assessment

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

Release of final mark

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.