



UNSW Course Outline

ZPEM2309 Engineering Mathematics 2A - 2024

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General Course Information

Course Code : ZPEM2309

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

The course covers two distinct topics. The first, Ordinary Differential Equations (ODEs), looks at the basics of mathematical modelling with ODEs -- in particular linear systems, Laplace transform methods, series solutions, phase planes and an introduction to non-linear systems of

ODEs. The second topic, Multivariable Calculus, looks at gradients, divergence, curl, multiple integrals, vector fields, vector fluxes and integral theorems. Both topics will use examples from engineering and applied mathematics.

Course Aims

This course aims to provide students with an understanding of the mathematics underlying modern Engineering and a mastery of the relevant techniques. It builds upon Engineering Mathematics 1A and 1B in the areas of Ordinary Differential Equations (ODEs) and Multivariable Calculus (MVC).

Course Learning Outcomes

Course Learning Outcomes
CL01 : identify the assumptions and variables of a simple mathematical model;
CL02 : recognise which techniques are applicable to a given ODE; use the appropriate techniques correctly
CL03 : interpret the behaviour of the solution;
CL04 : be familiar with Laplace transforms and their application to ODEs.
CL05 : Evaluate double and triple integrals; including to reverse the order of intergation
CL06 : understand the importance of line integrals and their applications
CL07 : set up and evaluate flux integrals
CL08 : apply the main theorems of vector calculus

Course Learning Outcomes	Assessment Item
CL01 : identify the assumptions and variables of a simple mathematical model;	• ODE test • Final Exam
CL02 : recognise which techniques are applicable to a given ODE; use the appropriate techniques correctly	• ODE test • Final Exam
CL03 : interpret the behaviour of the solution;	• ODE test • Final Exam
CL04 : be familiar with Laplace transforms and their application to ODEs.	• ODE test • Final Exam
CL05 : Evaluate double and triple integrals; including to reverse the order of intergation	• MVC test • Final Exam
CL06 : understand the importance of line integrals and their applications	• MVC test • Final Exam
CL07 : set up and evaluate flux integrals	• MVC test • Final Exam
CL08 : apply the main theorems of vector calculus	• MVC test • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

The two topics in the course will be taught sequentially—ODEs in the first half of the semester and MVC in the second half. This will enable the weekly tutorials to focus entirely on the topic that is currently being taught. You will achieve the most out of this course by doing the set

exercises.

Students are expected to have read the relevant sections of the course notes prior to each lecture. While lectures will cover most of the material for the course, they will concentrate on developing

students’ understanding of the concepts through problem solving.

Tutorials will give students the opportunity to resolve any difficulties they have with the material and to gain further practice in mathematical problem-solving in an engineering context. Attendance at tutorials is compulsory and students are expected to have attempted the assigned exercises prior to each tutorial.

Tutorials will start in Week 2.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
ODE test Assessment Format: Individual	25%	Start Date: Wednesday 3 April Due Date: Not Applicable
MVC test Assessment Format: Individual	25%	Start Date: Wednesday 29 May Due Date: Not Applicable
Final Exam Assessment Format: Individual	50%	Start Date: End of semester exam period Due Date: Not Applicable

Assessment Details

ODE test

Assessment Overview

Covers material on linear algebra and its applications to systems of linear ODEs.

Course Learning Outcomes

- CL01 : identify the assumptions and variables of a simple mathematical model;
- CL02 : recognise which techniques are applicable to a given ODE; use the appropriate techniques correctly
- CL03 : interpret the behaviour of the solution;
- CL04 : be familiar with Laplace transforms and their application to ODEs.

Detailed Assessment Description

Covering material on linear algebra including finding eigenvalues and eigenvectors and their applications to solving systems of linear first-order differential equations.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

MVC test

Assessment Overview

Covers material on multivariable calculus, including multiple integrals, line and surface integrals, and the application of Stokes and divergence theorems.

Course Learning Outcomes

- CL05 : Evaluate double and triple integrals; including to reverse the order of integration
- CL06 : understand the importance of line integrals and their applications
- CL07 : set up and evaluate flux integrals
- CL08 : apply the main theorems of vector calculus

Detailed Assessment Description

Material covers relevant sections of MVC, with a focus multiple integrals, line integrals and surface integrals.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

Final Exam

Assessment Overview

Covers the entire course.

Course Learning Outcomes

- CL01 : identify the assumptions and variables of a simple mathematical model;
- CL02 : recognise which techniques are applicable to a given ODE; use the appropriate techniques correctly
- CL03 : interpret the behaviour of the solution;

- CLO4 : be familiar with Laplace transforms and their application to ODEs.
- CLO5 : Evaluate double and triple integrals; including to reverse the order of integration
- CLO6 : understand the importance of line integrals and their applications
- CLO7 : set up and evaluate flux integrals
- CLO8 : apply the main theorems of vector calculus

Detailed Assessment Description

The final exam covers the entire course, and is of 3 hours in duration. It is a closed book exam.

Assessment Length

3 hours + 30 min to upload solutions to Moodle

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Use of AI in assessment:

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

The assessment for the course has been designed so that an overall mark of 50% or greater indicates that the student has unambiguously demonstrated satisfactory completion of each learning outcome. For this reason students who receive less than 50% overall for the course will receive a Fail grade.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	Systems of linear equations; matrix equations; determinants; vectors and linear independence
Week 2 : 4 March - 8 March	Lecture	Linear systems of first-order differential equations; diagonalisation; eigenvalues and eigenvectors; characteristic equation with real and distinct eigenvalues
Week 3 : 11 March - 15 March	Lecture	Complex eigenvalues; repeated eigenvalues
Week 4 : 18 March - 22 March	Lecture	Phase-plane analysis
Week 5 : 25 March - 29 March	Lecture	Laplace transforms – definition and first principles; tables of Laplace transforms; inverse Laplace transforms
Week 6 : 1 April - 5 April	Assessment	ODE class test – Wednesday 3 April
	Lecture	Laplace transforms – convolution integral; application to systems of ODEs
Week 7 : 22 April - 26 April	Lecture	Wednesday 24 April – Military Training Day No other lectures or tutorials on this week
Week 8 : 29 April - 3 May	Lecture	Double integrals – Cartesian and polar coordinates; reversing the order of integration Triple integrals – Cartesian coordinates, different orders of integration
	Tutorial	Triple integrals – Cylindrical and spherical coordinates; applications
Week 9 : 6 May - 10 May	Lecture	Friday 10 May lost. Those attending the Friday tutorial should attend, where possible, either the Wednesday tutorial at 11 am in SR04 or the Thursday tutorial at 3 pm in SR07.
Week 10 : 13 May - 17 May	Lecture	Parameterising curves in space; vector fields; line integrals; applications
Week 11 : 20 May - 24 May	Lecture	Surface integrals
Week 12 : 27 May - 31 May	Assessment	MVC class test – Wednesday 29 May
	Lecture	Applications of Stokes theorem and of the divergence theorem.
Week 13 : 3 June - 7 June	Lecture	Revision

Attendance Requirements

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

Course Resources

Prescribed Resources

NIL.

Course notes may be accessed via Moodle.

Recommended Resources

Lecture notes will be made available however, the following resources may be helpful in providing an alternative approach.

- Virginia W. Noonburg, Ordinary Differential Equations, MAA 2014.
- M. Spiegel et al., Schaum's Outlines Vector Analysis, 2nd edition, McGraw-Hill.
- Hughes-Hallett, D et al, Calculus: Single and Multivariable, Wiley, 6th edition.

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	Zlatko Jovanoski		Rm132B (Building 26)		I am available for email, Teams or Zoom consultations at any time, and for in-person consultations during normal working hours.	No	Yes

Other Useful Information

Academic Information

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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 Equitable 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 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. All students are expected to adhere to UNSW's Student Code of Conduct. Find relevant information at: [Student Code of Conduct \(unsw.edu.au\)](https://www.student.unsw.edu.au/student-code-of-conduct)

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.