School of
Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

Prescription

This course will cover fundamental concepts in linear algebra and multivariable calculus and their applications to physical and engineering problems. Mathematical software will be used extensively. Topics covered will include dimensionality, linear transformations, matrix decomposition, Taylor series, calculus of vector-valued functions and calculus of two-variable functions.

Course learning objectives

Students who pass this course should be able to:

1. State the definitions of fundamental concepts in linear algebra and multivariable calculus.
2. Demonstrate ways in which linear algebra and multivariable calculus can be used to model physical and engineering problems.
3. Apply concepts and techniques in linear algebra and multivariable calculus to solve physical and engineering problems, both manually and using software tools when appropriate.

Course content

The course is primarily offered in-person, and the tests and laboratories will require in-person attendance for all students in the Wellington region. However, there is a remote option with online alternatives for all components of the content and assessment of the course, for students who cannot attend in-person.

Students taking this course remotely will require access to a computer with camera and microphone and a reliable high speed internet connection able to support real-time video and audio connections, screen-sharing, and Zoom. A mobile phone connection only is not sufficient. The computer must also be adequate to support the programming required by the course: almost any modern windows, Macintosh, or Unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

Students who require the remote test option should contact the course coordinator in the first two weeks to make arrangements.

Withdrawal from Course

Withdrawal dates and process:
https://www.wgtn.ac.nz/students/study/course-additions-withdrawals

Lecturers

Dr Peter Donelan (Coordinator)

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CO 424 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

Dr Howard Lukefahr

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CO 341 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

Teaching Format

This course will be taught in dual mode using a combination of lectures and computer labs. Attendance in person is strongly recommended, if possible. There will be two 50-minute lectures per week for 12 weeks, and a 2-hour computer lab per week starting in Week 2. Lectures will be used to introduce fundamental concepts along with techniques for modelling and solving problems. The computer labs will be used to teach software tools that can implement mathematical models and visualise problems, as well as compute solutions to them.

Dates (trimester, teaching & break dates)

- Teaching: 28 February 2022 - 03 June 2022
- Break: 11 April 2022 - 24 April 2022
- Study period: 06 June 2022 - 09 June 2022
- Exam period: 10 June 2022 - 25 June 2022

Class Times and Room Numbers

28 February 2022 - 10 April 2022

- **Tuesday** 11:00 - 11:50 – LT220, Hunter, Kelburn
- **Wednesday** 11:00 - 11:50 – LT220, Hunter, Kelburn
- **Thursday** 11:00 - 11:50 – LT118, Laby, Kelburn

25 April 2022 - 05 June 2022

- **Tuesday** 11:00 - 11:50 – LT220, Hunter, Kelburn
- **Wednesday** 11:00 - 11:50 – LT220, Hunter, Kelburn
- **Thursday** 11:00 - 11:50 – LT118, Laby, Kelburn

Other Classes

Labs will start in Week 2, and are two hours a week.

Set Texts and Recommended Readings

Required

There are no required texts for this offering.

Recommended

- "Engineering mathematics : a foundation for electronic, electrical, communications and systems

engineers" (5th edition) by Anthony Croft and Robert Davison is a useful support book for this course, though it does not cover all the content and also includes material from 100-level and otherwise not in this course. Lecture notes will be provided.

Mandatory Course Requirements

There are no mandatory course requirements for this course.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

For engineering, mathematics provides an incredibly powerful set of tools and techniques for representing physical situations - these are mathematical models - and using them to explain and make predictions about the world and our observations of it. When we learn mathematics, we aim to understand how these models work, and how they build on what we already know. To help us build our undestanding, we try to solve mathematical problems. This involves accurate calculation, knowing and understanding the rules of mathematical manipulation, following logical arguments, clearly explaining our mathematical reasoning both for ourselves and others, and seeing how abstraction can create analogies between different situations and models.

To test how well our understanding is developing, we need to attempt to apply techniques and solve problems regularly. In this and in most mathematics courses, we set regular **assignments** to help do this. They are intended to prompt you to undertstand what you have been learning in classes and through reading, so they are part of your learning process. But they take time and effort and so we want to encourage and reward you for this. So, while assignments are part of your learning, we also make them part of the assessment.

Engineers also want to make sure their calculations are accurate and computers help greatly with this. Many mathematical techniques are computational and can be carried out by computer programmes. So another part of this course is learning one programming language that is helpful for mathematics and data analysis, namely Python. We will assess your ability to use Python as a computational tool through weekly computer laboratories.

Finally, mathematical ideas and connections between them take time to form in our minds. So we also want to assess your learning when this has had time to take place. The two tests that form part of the assessment enable you to demonstrate your mathematical knowledge and abilities in this cumulative way.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
6 assignments, each requiring approximately 10 hrs work: due in weeks 2,4,6,8,10,12	TBC	CLO: 2,3	25%
Notebooks for 10 computer laboratories, each 2 hours plus additional time as necessary (each week except weeks 1 and 12)		CLO: 2,3	25%
Test (2 hour duration): week 7		CLO: 1,2,3	25%
Test (2 hour duration): study/exam period	TBC	CLO: 1,2,3	25%

Penalties

Late assignments are not marked. Extensions may be granted in exceptional circumstances but must be sought before the deadline.

Extensions

Extensions must be asked for before the due date, and will be treated on a case by case basis by the lecturer. Assignments are due most weeks so extensions will normally be granted for no more than three days.

Submission & Return

Assignment answers are to be submitted online by the due time using the ECS submission system. Marked assignments will be returned online to provide feedback on progress.

Marking Criteria

When you are writing out solutions to problems in mathematics, you will need to use quite a lot of symbolic notation. It is important to learn how to use this correctly. It is also important to explain your answers so that someone else can clearly follow your reasoning. So as well as using equations and formulas, you will also need to use ordinary language to clarify your thinking for the assessors. See how this is done in examples and worked solutions so you can see what is expected.

Marks will be given for correct working and use of correct methods, for clear logical explanations, correct use of notation and, where helpful, for diagrams and graphs. In programming exercises, correct use of syntax and explanatory comments will gain maximum marks. Where possible, we will give credit for correct working even where it is based on an earlier mistake, so long as that does not significantly simplify the problem.

Workload

The student workload for this course is 150 hours.

Teaching Plan

Communication of Additional Information

Information will be communicated to students by posting it on the course Blackboard site.

Links to General Course Information

- Academic Integrity and Plagiarism: https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism
- Academic Progress: https://www.wgtn.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement)
- Dates and deadlines: https://www.wgtn.ac.nz/students/study/dates
- Grades: https://www.wgtn.ac.nz/students/study/progress/grades
- Special passes: Refer to the Assessment Handbook, at https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf
- Statutes and policies, e.g. Student Conduct Statute: https://www.wgtn.ac.nz/about/governance/strategy
- Student support: https://www.wgtn.ac.nz/students/support
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter
- Terms and Conditions: https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract
- Turnitin: http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin

- University structure: https://www.wgtn.ac.nz/about/governance/structure
- VUWSA: http://www.vuwsa.org.nz

Offering CRN: 33042

Points: 15
Prerequisites: (ENGR 121, 122) or (MATH 142, 151)
Duration: 28 February 2022 - 26 June 2022
Starts: Trimester 1
Campus: Kelburn