

NMM 1411A
Linear Algebra with Numerical Analysis for Engineering

Course outline for Fall 2026

1. Technical Requirements:



Stable internet connection



Laptop or computer with
[MATLAB installed](#)



Working microphone



Working webcam

2. Course Information and Important Dates:

Course: NMM 1411A - Linear Algebra with Numerical Analysis for Engineering

Academic Term: Fall 2026

LEC 001 M/W/F 3:30pm-4:20pm, NCB-101



Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 9	October 10 - 18	December 9	December 10	December 11 - 22

* November 30, 2026: Last day to drop A half course without penalty

3. Contact Information

Course Coordinator	Contact Information
LEC 001: Prof. Alex Buchel	abuchel@uwo.ca



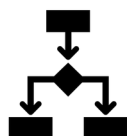
4. Course Description and Design

Matrix operations, systems of linear equations, linear spaces and transformations, determinants, eigenvalues and eigenvectors, applications of interest to Engineers including diagonalization of matrices, quadratic forms, orthogonal transformations; introduction to MATLAB with applications from linear algebra.

Antirequisite(s): Mathematics 1600A/B.

Prerequisites: Ontario Secondary School MHF4U or MCV4U, or Mathematics 0110A/B

Restricted to students in the Faculty of Engineering.



Mode	Section	Frequency
In-person	LEC 001	3 lectures/weekly
In-person	TUT/Lab 002-006	1-hour weekly for each subsection

- ☒ Attendance at lecture/TUT/Lab sessions is strongly recommended
- ☒ Tests administered during TUT/Lab sections, attendance is mandatory

All course material will be posted on Brightspace: <https://westernu.brightspace.com/>.

Students are responsible for checking the course OWL site (<https://westernu.brightspace.com/>) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the [OWL Brightspace Help](#) page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Learning Outcomes

General learning objectives:

- Understand where linear equations arise in engineering.
- Understand the concepts of consistent and inconsistent equations.
- Understand the concept of a linear transformation.
- Understand the concept of an eigenvector.
- Introduction to Matlab software as a tool for computerized solution of linear algebra problems.



Specific learning objectives:

- Engineering Applications: electrical networks, pipe and traffic flow, data fitting
- Systems of Linear Equations: solving systems of linear equations by Gaussian elimination
- Matrices: matrix operations, inverses, elementary matrices, special types of matrices
- Determinants: cofactor expansion, properties, Cramer's rule
- Linear transformations: linear mapping between vector spaces, matrix

representation of linear transformations

- Orthogonality: inner product, orthonormal bases, Gram-Schmidt process, least-squares approximations, orthonormal matrices
- Eigenvectors: finding eigenvalues and eigenvectors, characteristic polynomial, properties of eigenvalues and eigenvectors, diagonalization, geometric and algebraic multiplicity, similarity, orthogonal diagonalization of real symmetric matrices

6. Course Content and Schedule (**tentative**)



Week	Dates	Lectures #	"Elementary Linear Algebra" #
0	Sep 9 -	Intro/logistics/	N/A
1	- Sep 18	1, 2	1.9, 1.1
2	Sep 21 – 25	3, 4, 5	1.1, 1.2, 1.3
3	Sep 28 – Oct 2	6, 7, 8	1.3, 1.4, 1.5
4	Oct 5 – 9	9, 10, 11	1.6, 1.7
5	Oct 12 – 16	Reading week	N/A
6	Oct 19 – 23	12, 13, 14	2.1, 2.2, 2.3, 1.8
7	Oct 26 - 30	15, 16, 17	1.8, 3.1, 3.2, 3.3
8	Nov 2 – 6	18, 19, 20	4.1, 4.2
9	Nov 9 – 13	21, 22, 23	4.2, 4.3, 4.4
10	Nov 16 – 20	24, 25, 26	4.4, 4.5, 4.7
11	Nov 23 – 27	27, 28, 29	4.8, 4.9, 5.1, 5.2
12	Nov 30 – Dec 4	30, 31, 32	5.2, 6.1, 6.2, 6.3
13+	Dec 7 – 9	33, 34	6.3, review

7. Contingency plan for an in-person class pivoting to 100% online learning



In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online as determined by the course instructor.

- ☒ Lectures are delivered asynchronously, tutorials/tests are in 'live' sessions
- ☒ Students are expected to participate and engage with content as much as possible

8. Evaluation

Below is the tentative evaluation breakdown for the course. Any deviations will be communicated.

Assessment	Format	Weighting	Due Date
Test 1	in-person	10%	Week4,duringTUT/Lab
Test 2	in-person	10%	Week8,duringTUT/Lab
Computer lab test	in-person	5%	Week12,duringTUT/Lab
Midterm exam	In-person	35%	Friday, Nov. 13, 2026, 7-10 pm
Final exam	in-person	40%	TBA

- ☒ Tests 1,2 and Computer Lab test will be during regular TUT/Lab sessions
- ☒ See "Tutorial_ComputerLab_schedule.pdf" document on Brightspace for details regarding the tests
- ☒ Details on the Final exam will be provided later (on Brightspace)

Generative AI tools are not permitted for any assessment listed above, including Test 1, Test 2, the Computer Lab Test, the Midterm Exam, and the Final Exam.

Information about Missed Coursework

Students must familiarize themselves with the University Policy on Academic Consideration – Undergraduate Students in First Entry Programs, posted on the Academic Calendar:

https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

For procedures on how to submit Academic Consideration requests, students should consult the Office of the Registrar's webpage:

https://registrar.uwo.ca/academics/academic_considerations/

In this course, missed in-term assessments are handled automatically as described below. Students do not need to submit an Academic Consideration request for a missed Test 1, Test 2, Computer Lab Test, or Midterm Exam. No makeup tests or makeup midterm will be offered, except for an early sitting required because of a university-sanctioned schedule conflict or religious accommodation. Academic Consideration requests with supporting documentation are still required for final examinations scheduled during the official examination period by the Registrar's Office.

The general Academic Consideration policy does not apply to requests submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities; such students should consult Accessible Education.

Evaluation Scheme for Missed Assessments :

- Missed Midterm -> the weight shifts automatically to the cumulative final; no makeup
- Missed Test 1,2, computer lab -> the weight shifts automatically to the cumulative final; no academic consideration request is required

Special Examination

Per university policy, Academic Consideration requests with supporting documentation are required for final examinations scheduled during official examination periods by the Registrar's Office.

If a student misses the Final Exam and is approved by the Academic Advising Office to write a Special Examination (SPC), and the final exam is their only outstanding course component, an SPC will be assigned and scheduled by the instructor according to university policy.

If the student misses their SPC exam and is approved for Academic Consideration, they will be withdrawn from the course without academic penalty. If they experienced extenuating circumstances such as prolonged illness, they may appeal to the Associate Dean (Academic), on a case-by-case basis, for the opportunity to write the final exam the next time the course is offered. An outstanding SPC may reduce their course load for the term in which the exam is deferred, as outlined in the Definitions of Types of Examinations policy.

If the student misses their SPC exam and Academic Consideration is not approved, or was not requested, they will receive a grade of zero on the exam.

Information about tests and examinations:

- ☒ Test 1,2 and Computer lab test will be 50min long (during regular TUT sessions), **closed book**
- ☒ Midterm examination will be 3h long, **closed book**.
- ☒ Final examination will be 3h long, **closed book**.

Use of Electronic Devices During Assessments

In this course, calculators, phones, computers, smart watches, smart glasses, wireless earbuds, hidden cameras, and any other unauthorized electronic or communication devices are not permitted during Test 1, Test 2, the Midterm Exam, or the Final Exam.

For the Computer Lab Test, students may use only the computer/software resources explicitly permitted by the instructor, including MATLAB help if authorized. No other electronic or communication devices are permitted.

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment is strictly prohibited. Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at a student's desk, on their person, or within reach during an assessment will be treated as a scholastic offence, even if the device is not in use.

Effective September 2026, the typical penalty for this offence is a failing grade in the course and a 12-month prohibition on retaking the course.

Only devices expressly permitted by the instructor may be brought into the assessment room. It is each student's responsibility to review and comply with these expectations.

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

9. Communication:

- ☒ Students should check the Brightspace site every 24 hours
- ☒ Emails will be monitored daily; students will receive a response in 24 – 48 hours
- ☒ **Emails outside @uwo domain will be ignored**



10. Office Hours:

- ☒ Office hours will be held in person



PAB 259, on Mondays 9:30-11:30am, starting Sep 14

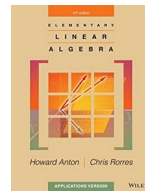
11. Resources



- ☒ All resources will be posted on Brightspace

Required textbook: "Elementary Linear Algebra", 11th or 12th edition by Howard Anton, Wiley (2014). Students may use either edition. Approximate costs for the 12th Edition Applications Version: looseleaf print (ISBN 9781119282365) \$169.95; 150-day eText rental (ISBN 9781119406723) \$65.00.

Western Bookstore course-materials link: https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2026A&courses%5B0%5D=001_UW/NMM1411A



- ☒ Additional resources: All books called linear algebra contain similar material.
Go to the library and browse the shelves around books catalogued at QA 184.

12. Professionalism & Privacy:

Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:



- ☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- ☒ Students will be expected to take an academic integrity pledge before some assessments

13. How to Be Successful in this Class:

Students enrolled in this class should understand the level of autonomy and self-discipline required to be successful.



- 1. Do suggested exercises – midterm and final exams are based on them!**
2. Make it a daily habit to log onto Brightspace to ensure you have seen everything posted to help you succeed in this class.
3. Take notes as you go through the lesson material. Keeping handwritten notes or even notes on a regular Word document will help you learn more effectively than just reading.
4. Connect with others. Try forming an online study group and try meeting on a weekly basis for study and peer support. Use of OWL Forums is encouraged.

5. Do not be afraid to ask questions. If you are struggling with a topic, contact your instructor(s) and/or teaching assistant(s).
6. Attend lectures/TUT/Lab sessions

14. Western Academic Policies and Statements

Accommodation for Religious Holidays

When a recognized religious holiday either requires a student to be absent from the University, or requires or prohibits an activity that makes it impossible for them to complete an academic requirement scheduled that day, they are entitled to accommodation. No student will be penalized for an absence for religious reasons, and an alternative means of satisfying the requirement will be arranged. This accommodation is provided in accordance with the University's policy on Accommodation for Religious Holidays:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Students should submit their requests through the Student Absence Portal (SAP) as soon as they identify a scheduling conflict, identifying the conflict and the specific course component affected, for example Test 1, Test 2, the Computer Lab Test, the Midterm Exam, or the Final Exam.

Tests and Midterm Exam: If a religious observance conflicts with Test 1, Test 2, the Computer Lab Test, or the Midterm Exam, the student must submit their request no later than one week before the assessment. The instructor will arrange an early sitting of the assessment. No makeup test or makeup midterm is offered for any other reason; this early sitting is available specifically for religious accommodation.

Final Exam: If a religious observance conflicts with the Final Exam, the student must submit their request no later than two weeks before the exam. The instructor will arrange a Special Examination to take place no later than one month after the end of the examination period.

Students are responsible for finding out what was covered in any class they miss due to a religious observance, and for taking the appropriate steps to keep up with the course.

If a suitable arrangement cannot be reached between a student and the instructor, the student should consult the Undergraduate Chair of the department offering the course, and if necessary, the Associate Dean (Academic) of the Faculty of Science.

For a list of recognized religious observances, please visit the calendars posted on the Equity, Diversity & Inclusion website:

<https://www.edi.uwo.ca/>

Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

Academic Policies

The website for Registrar Services is <https://www.registrar.uwo.ca/>.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Scholastic offences are taken seriously and students are directed to read the appropriate policies, specifically the definition of what constitutes a Scholastic Offence and the Procedure for Undergraduate Scholastic Offences, at the following websites:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_offences_26SEP.pdf

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Use of Generative AI Tools

The use of generative AI tools, including but not limited to ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms, is not permitted in the completion of any course assessments, including Test 1, Test 2, the Computer Lab Test, the Midterm Exam, and the Final Exam.

Using such tools for content generation, code writing, problem solving, translation, summarization, or checking answers will be treated as a scholastic offence.

For the Computer Lab Test, students may use only the computer/software resources explicitly permitted by the instructor, including MATLAB help if authorized. This permission does not include the use of generative AI tools or AI-assisted coding tools.

It is each student's responsibility to seek clarification before using any AI tools in connection with course work.

15. Academic Policies and Statements

Copyright and Audio/Video Recording Statement

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws. You must always ask permission to record another individual and you should never share or distribute recordings.

Class Median Mark Statement

The Department of Physics and Astronomy may, in exceptional cases, adjust the final course marks in order to conform to Departmental policy:

"Classes with enrolments greater than 25 are required to have a median grade in the range of 65 to 75%"

Rounding of Marks Statement

Across Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. *Final grades* in this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

16. Support Services

Please visit the Science and Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: <https://www.uwo.ca/sci/advising/index.html>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.

17. Addendum to all Numerical Mathematical Methods Course Outlines

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

18. Breakdown: Engineering Science = 100%