NMM 1411A
Linear Algebra with Numerical Analysis for Engineering

Course outline for Fall 2025

1. Technical Requirements:


Stable internet connection


Laptop or computer with MATLAB installed


Working microphone


Working webcam

Delivery Mode: in-person	Dates	Time

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 4	November 3 - 9	December 5	December 10	December 11 - 22

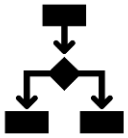
* November 28, 2025: Last day to drop A half course without penalty

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

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

This policy does not apply to requests for Academic Consideration 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. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests normally must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this, and therefore always require formal supporting documentation:

- Examinations scheduled during official examination periods
- Midterm exam

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments (ONLY with an approved academic consideration request - whether it be documented or undocumented, subject to the conditions specified in the course outline for undocumented absences**):**

- Missed Midterm -> reweighting to the Final exam
- Missed Test 1 -> reweighting to Test 2
- Missed Test 2 -> reweighting to Midterm exam
- Missed Computer lab test -> reweighting to Final exam

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

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.

☒ Calculators/phones/computers etc. will not be allowed during any tests; MATLAB help is allowed during Computer lab test

☒ The use of ANY communication devices is strictly prohibited.

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

☒ Emails will be monitored daily; students will receive a response in 24 – 48 hours

☒ **Emails outside @uwo domain will be ignored**

10. Office Hours:

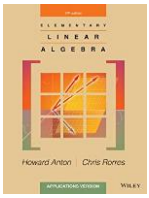
☒ Office hours will be held in person

PAB 259, on Mondays 9:30-11:30am, starting Sep 15

11. Resources

☒ All resources will be posted on Birghtspace

☒ Required textbook: ``Elementary Linear Algebra" 11th or 12th edition by Howard Anton, Wiley (2014)



☒ 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 conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

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 policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

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

Proctoring Software may be used in this course in the event of health lock-down:
In case of such a lock-down, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

https://remoteproctoring.uwo.ca.

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 Medium 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*** on 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.

Remote Proctoring Software will be used in this course in the event of health lock-down

Tests and examinations in this course are planned in-person. In the event of health lockdown, all the remaining tests and examinations will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: https://remoteproctoring.uwo.ca.

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 & 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/counselling/.

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%