

Numerical and Mathematical Methods 1411A (NMM 1411A)

Fall 2024

Course Outline

1. Course Information

Course Name: Linear Algebra with Numerical Analysis for Engineering Students

Course Number: NNM 1411A

Academic Term: FW24

Prerequisite(s): Ontario Secondary School MHF4U or MCV4U, or Mathematics 0110A/B.

Antirequisite(s): Mathematics 1600A/B, the former Applied Mathematics 1411A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees if you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Dr. Natalia Kiriushcheva

Email: nkiriush@uwo.ca

Office hours: TBA.

Teaching assistants:

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Students must use their Western (@uwo.ca) email addresses when contacting their instructors and put “NNM1411A” in the subject line in addition to other identifiers. Remember to check announcements on our OWL page before contacting your instructor.

Section	Dates	Time	Location
LEC 001	M/W/F		
TUT 002	Th		
TUT 003	Th		
TUT 004	M		
TUT 005	W		
TUT 006	Th		

See the complete tutorial and lab schedule in the course website at OWL Brightspace.

Extra Help: Math-Physics Accelerator Help Centre will be available during the term. Information and the calendar of its work can be found in this link:

https://www.physics.uwo.ca/undergraduate/current_students/mathphysics_accelerator.html.

3. Course Syllabus, Schedule, Delivery Mode

Course Syllabus Description

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.

General Learning Objectives

The general objectives for student are:

- 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. Specific Learning Objectives
- Engineering Applications: electrical networks, pipe and traffic flow, data fitting.

Topics

- **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
- **Vector spaces:** definition of a vector space and subspace, linear independence, basis and dimension, row space, column space, nullspace, rank and nullity
- **Orthogonality:** inner product, orthonormal bases, Gram-Schmidt process, least-squares approximations, orthonormal matrices
- **Eigenvalue problems:** finding eigenvalues and eigenvectors, characteristic polynomial, properties of eigenvalues and eigenvectors, diagonalization, geometric and algebraic multiplicity, similarity, orthogonal diagonalization of real symmetric matrices
- **Linear transformations:** linear mapping between vector spaces, matrix representation of linear transformations
- **Additional topics on application:** introduction to Matlab, data fitting using least-squares solutions, quadratic forms, other engineering applications

Tentative Course Content Schedule

	week	textbook sections	notes
0	Sept 5 - 6	1.10 (start)	Introduction to the course
1	Sept 9 - 13	1.1, 1.2	
2	Sept 16 - 20	1.3, 1.4, 1.5	
3	Sept 23 - 27	1.6, 1.7, 1.10 (continue)	Test 1
4	Oct 1 - 4	2.1, 2.2, 2.3	
5	Oct 7 - 11	3.1, 3.2, 3.3	
6	Oct 12 - 20		The reading week
7	Oct 21 - 25	4.1, 4.2, 4.3	
8	Oct 28 – Nov 1	4.4, 4.5, 4.6	Test 2
9	Nov 4 - 8	4.7, 4.8, 4.9	
10	Nov 11 - 15	5.1, 5.2	
11	Nov 18 - 22	6.1, 6.2	Test 3 (Matlab)
12	Nov 25 - 29	6.3, 4.11	

13	Dec 2 - 6	7.1, 7.2	
	Dec 9 - 22		The examination period

Some adjustments to the above plan may be made and posted on the course website at OWL Brightspace as the course progresses.

The Department of Physics and Astronomy may adjust the final course marks in order to conform to Departmental policy. Please note that the course outline may be modified, including evaluation weights, in case the University will move the course online.

Key sessional dates for Fall of 2024

- Sept. 5 Classes begin
- Sept. 13 Last day to add a full-course or a first-term half course or drop a course without showing WDN
- Sept. 30 National Day for Truth and Reconciliation (observed at Western). No classes.
- Oct. 12-20 Fall Reading Week (including Thanksgiving, Oct. 14)
- Dec. 2 Last day to withdraw from a first-term half course or full-year course without academic penalty (extended from Sat. Nov. 30)
- Dec. 6 Last day of classes in the Fall term
- Dec. 7-8 Study Days
- Dec. 9–22 December examination period

4. Course Materials

Required Text:

[Elementary Linear Algebra Ebook Wileyplus Bundle](#) , that includes access to the following textbook, student solution manual, Matlab manual, and online quizzes:

“Elementary Linear Algebra. Applications Version”, 12th Edition, by Howard Anton, Chris Rorres, and Anton Kaul, John Wiley & Sons

“Student Solutions Manual for Elementary Linear Algebra. Applications Version”, 12th Edition, by Howard Anton, Chris Rorres, and Anton Kaul, John Wiley & Sons (Optional)

“Matlab Manual for Elementary Linear Algebra. Applications Version”, 12th Edition, by Howard Anton, Chris Dorres, and Anton Kaul, John Wiley & Sons (Optional)

Information of how to set your account on WileyPlus will be posted on the course website at OWL Brightspace.

Students are responsible for checking the course OWL Brightspace site

(<https://westernu.brightspace.com/d2l/login>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

A list of suggested exercises from the text will be provided in OWL Brightspace.

Any additional or supplementary course material will be posted to OWL Brightspace course website.

If students need assistance with the course OWL Brightspace site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk (<https://wts.uwo.ca>). They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

Gradescope (<https://www.gradescope.ca/>) will be used as a grading platform for some written work (including tests and final exam) in the course. A free account will be created on your behalf.

Online quizzes will be set using WileyPlus platform

Additionally, students will need:

- a laptop or computer;
- a stable internet connection;
- to have installed recent versions of Chrome AND Firefox browsers, a pdf reader.

5. Methods of Evaluation

15% **First Tutorial Test** - week of September 23, 2024

15% **Second Tutorial Test** - week of October 28, 2024

10% **Third Tutorial (Matlab) Test** - week of November 18, 2024

10% **Online quizzes** – 6 quizzes in total, 5 the best will be counted

50% **Final Examination** (TBA in the December examination period)

The tutorial tests will be one hour long, closed book. The final exam will be three hours long, closed book. No electronic devices are allowed during the tests and final examination

- The use of calculators and communication devices during the test and final exam is prohibited.
- Missing a quiz, test, the final exam will result in a grade of zero unless appropriate permission is sought and granted. In that case, your mark may be re-weighted, or a makeup evaluation may be arranged.
- The final exam will be cumulative, 180 minutes in duration, and will consist of a mixture of short answer and multiple-choice or True/False questions. *This will be an in-person closed book exam. No notes, calculators, or other aids will be permitted.*

Click [here](#) for a detailed and comprehensive set of policies and regulations concerning examinations and grading. The table below outlines the University-wide grade descriptors.

A+	90-100	One could scarcely expect better from a student at this level
A	80-89	Superior work which is clearly above average
B	70-79	Good work, meeting all requirements, and eminently satisfactory
C	60-69	Competent work, meeting requirements
D	50-59	Fair work, minimally acceptable
F	below 50	Fail

Professionalism and Privacy

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

- Students are expected to follow online etiquette expectations provided on OWL Brightspace.
- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared.
- Recordings are not permitted (audio or video) without explicit permission.
- Permitted recordings are not to be distributed.
- Students will be expected to take an academic integrity pledge before some assessments.
- All recorded sessions will remain within the course site.

6. Student Absences

Western Academic Policies and Statements

Absence from Course Commitments

[Academic Consideration for Absences - Academic Consideration for Absences - Western University \(uwo.ca\)](#)

In the interest of the health and safety of students and health care providers, you are no longer required to seek a medical note for absences this term. If you are unable to meet a course requirement due to illness you should use the [Illness - Absence - Illness - Western University \(uwo.ca\)](#). This tool takes the place of the need to submit a medical note and the Self-Reported Absence System formally used by undergraduate students.

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) For work worth less than 10% of the total course grade (a homework assignment, for example) your LEC instructor is empowered to grant academic considerations without the need to contact counselling. To seek accommodations for work totaling less than 10% of your course grade please send an email to your LEC instructor in a timely manner.
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.
- (iv) For work totalling 10% or more of the final course grade, **you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible.**

For further information, please consult the University's medical illness policy at [Illness - Absence - Illness - Western University \(uwo.ca\)](#).

The Student Medical Certificate is available at [medicalform.pdf \(uwo.ca\)](#).

Missed assessments can only be excused through one of the mechanisms above. In all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences must be submitted to the Academic Counselling office of a student's Home Faculty.**

Accommodated Evaluations

Missing a test or the due date of a submitted homework assessment will result in a grade of zero unless appropriate permission is sought and granted. In the case of quizzes and homework assignments and appropriate accommodation, your mark will be re-weighted to exclude the missed assessment. In the case of a missed midterm, a makeup test will be arranged. If a student misses a term test and the corresponding makeup test and has appropriate permission for both, then the final exam will be re-weighted to include the weight of the missed term test.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

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).

THE MAKE-UP EXAM FOR THIS COURSE WILL OCCUR NO LATER THAN AUGUST 31, 2024.

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under “Special Examinations.”)

7. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at [Office of Equity, Diversity and Inclusion - Western University \(uwo.ca\)](https://www.uwo.ca/equitydiversityinclusion/).

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: [Academic Accommodation - Academic Support & Engagement - Western University \(uwo.ca\)](https://www.uwo.ca/academic-support-engagement/).

8. Academic Policies

The website for Registrarial Services is [Office of the Registrar - Western University \(uwo.ca\)](#).

In accordance with policy, [mapp113.pdf \(uwo.ca\)](#), 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 his/her official university address is attended to in a timely manner.

The use of calculators and other electronic devices during the term tests or final exam is prohibited.

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:

[scholastic discipline undergrad.pdf \(uwo.ca\)](#).

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.

In the event of a health 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:

[Remote Proctoring - Office of the Registrar - Western University \(uwo.ca\)](#).

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters:

[Science & Basic Medical Sciences Academic Advising - Science & Basic Medical Sciences Academic Advising - Western University \(uwo.ca\)](#)

Students who are in emotional/mental distress should refer to Wellness & Well-being [Mental Health Support - Health & Wellness - Western University \(uwo.ca\)](#) 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/gbsv/index.html>.

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

Please contact your 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 [Accessible Education - Academic Support & Engagement - Western University \(uwo.ca\)](#) if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre [Learning Development & Success - Western University \(uwo.ca\)](#) 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 around 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: [Your Student Experience - Western University \(uwo.ca\)](#).

Additional student-run support services are offered by the USC, [Services - Western USC](#).