UNIVERSITY of GUELPH

ENGG*1500 Engineering Analysis

01

Fall 2023

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - August 31, 2023

_____

1 Course Details

1.1 Calendar Description

This course deals with engineering applications of matrix algebra, vector spaces and computer techniques to solve linear systems. Topics include theory and applications of linear transformations, eigenvalues and eigenvectors, diagonalization, complex-variable algebra, and multi-variable functions.

Restrictions:	MATH*1160, MATH*2150, MATH*2160. This is a Priority Access Course. Enrolment may be restricted to students in the BENG and BENG:C programs. See department for more information. Non-BENG students may take a maximum of 4.00 ENGG credits.

1.2 Course Description

This is an introductory course in linear algebra. Linear algebra is one of the most important subjects that you will study in Engineering, as it is used in many courses and design projects. The main goal of the course is to give you a solid foundation in the elementary concepts of linear algebra and to give you exposure to real problems that you will use throughout your engineering career.

1.3 Timetable

Lectures: Tuesday, Thursday 8:30 -9:50 AM, ROZH, Room 103 and 106 (extra)

Laboratory: THRN 2313 (max capacity: 55) and THRN1319 (max capacity: 65), change of lab sessions need the permission of the TA pending the availability of computers. All Monday

sessions will be in THRN1319, while all Tuesday sessions will be in THRN2313.

- Session A (0101): 2:30PM - 4:20PM (Monday, odd-weekly, e.g., week 1, 3, 5)
- Session B (0102): 2:30PM - 4:20PM (Monday, even-weekly, e.g., week 2, 4, 6)
- Session C (0103): 2:30PM - 4:20PM (Tuesday, odd-weekly)
- Session D (0104): 2:30PM - 4:20PM (Tuesday, even-weekly)

1.4 Final Exam

Final exam: December 13, 2023, 11:30AM -1:30PM, location TBA

The final exam will be in person and closed-book. One double-page A4 crib sheet is allowed.

_____

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Sheng Yang PhD
Email:	syang19@uoguelph.ca
Telephone:	5198244120 ext 58677
Office:	RICH 3501
Office Hours:	Mon & Tues 1:00PM- 2:00PM on Teams

2.2 Teaching Assistants

Teaching Assistant:	Alexander Ratsamany
Email:	aratsama@uoguelph.ca
Teaching Assistant:	Mohammad Vahid Ehteshamfar

Email:	mehtesha@uoguelph.ca
Teaching Assistant:	Vahid Haseltalab
Email:	vhaselta@uoguelph.ca
Teaching Assistant:	Enshen Zhu
Email:	enshen@uoguelph.ca
Teaching Assistant:	Joelle Tiangco
Email:	jtiangco@uoguelph.ca

_____

3 Learning Resources

3.1 Required Resources

Course Website (Website)
https://courselink.uoguelph.ca/
Course material, news, announcements, and grades will be regularly posted to the ENGG*1500 Courselink site. You are responsible for checking the site regularly.

Introduction to Linear Algebra for Science and Engineering 3rd ed. (Textbook)
D. Norman and D. Wolczuk, 2020, Pearson.

_____

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:
1. Carry out operations on vectors and matrices
2. Characterise vector sets and sub-spaces based on linear combinations, linear independence, and bases
3. Set up, manipulate, and solve systems of linear equations for a variety of engineering applications.
4. Solve matrix mapping problems.
5. Comprehend bases and dimensions of column, row, and null spaces and determine vectors in these sub-spaces

6. Calculate and comprehend determinants, eigenvalues and eigenvectors
7. Describe and evaluate the properties of matrices including inverse matrices, identity matrices, and transpose matrices.
8. Apply the concepts of determinant , eigenvalues, and eigenvectors to solve linear algebra problems
9. Calculate and comprehend complex numbers
10. Use Matlab to solve linear algebra problems.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
1.3	Recall, describe and apply fundamental engineering principles and concepts	3, 8, 10
5	Use of Engineering Tools	3, 10
5.2	Demonstrate proficiency in the application of selected engineering tools	3, 10
7	Communication Skills	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	3, 10
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	1, 2, 3, 4, 5, 6, 7, 8, 9, 10

5 Teaching and Learning Activities

5.1 Lecture Schedule

The following is a rough guideline for the lecture topics and is subject to change:

- Lectures 1-2 - **Introduction to vectors**: notation, scalar multiplication, vector addition, vector definition, basic vector/matrix forms (Identity, transpose, diag, etc.), linear combinations
- Lectures 3-5 - **Solving systems of linear equations (SLE)**: reduced row echelon form, irrigation example
- Lectures 6-7 - **Existence and uniqueness**: homogeneous and general forms, irrigation and chemical balance applications
- Lectures 8-9 -**Spaces**: Subspace and vector spanning, bases, dimensions, rank, column space, null space.
- Lectures 10-11 -**Summative review**: Sensor mapping problem, mind-map
- Lecture 12 - **Proofs**
- Lecture 13-14 - **Coordinates and projection**: Norm, dot product, projection, perpendicular, coordinates, closest point
- Lectures 15-16 - **Additional Matrix concepts**: matrix multiplication, determinant, inverse
- Lectures 17-18 - **Eigenvalues and eigenvectors**: characteristic polynomial, eigenspaces, algebraic and geometric multiplicity, Principal Component Analysis application (part 1)
- Lecture 19 - **Summative review**: PCA
- Lecture 20-21 - **Diagonalization**: matrix diagonalization, updated equations, Markov
- Lecture 22 - **Complex numbers**: addition, multiplication, conjugate
- Lecture 23 - 24 - **Summative review**: convergence of general update equations, mind map

5.2 Other Important Dates

Oct 7-10 Fall break

Oct. 10 class rescheduled to Nov 30.

Dec 4th (examination commences)

https://calendar.uoguelph.ca/undergraduate-calendar/schedule-dates/fall-semester/

_____

6 Assessments

6.1 Marking Schemes & Distributions

- Midterm 1: 20%
- Midterm 2: 20%
- Tutorial and Lab MATLAB Assessments: 10%
- Final: 50%

The scheme below assumes that you do better on all tests than on the final exam.

- If you do better on the final exam than on Test 1 and **your grade of Test 1 is higher than 50%**, the weight of Test 1 will be moved to the final. In other words, if your grade is lower than 50% in Test 1, the weight will remain as is.
- If you do better on the final exam than on Test 2 and **your grade of Test 2 is higher than 50%**, the weight of Test 2 will be moved to the final. In other words, if your grade is lower than 50% in Test 2, the weight will remain as is.
- If you missed any term test due to medical reasons (school policy applies), **you must notify the professor ASAP** and a make-up exam will be scheduled before or after the term test with collective availability**. If no notice is received by the professor within 1 week after the exam, no make-up exam will be provided, and you will receive zero for the corresponding test**.
- **Be noted: all the weights of the lab test are not transferrable to the final!**

6.2 Assessment Details

MATLAB Assessments (10%)
Date: Assessment 1: Week 5-6; Assessment 2: 11-12
Learning Outcome: 1, 3, 4, 6, 7, 8, 9, 10
The lab test scheduled on Oct. 9 and 10 will be moved to Oct. 16 and 17 respectively for students in Session 0101 and 0102. Other sessions will follow the scheduled lab slots.

There are two (2) tutorial/lab assessments that will be completed during the scheduled tutorial time. Grades are allocated based on assessment of MATLAB code. Please see Courselink for guidelines, schedules and expectations for each lab. Please attend your assigned tutorial section.

Midterm 1 (20%)
Date: Sat, Oct 14, 6:00 PM - 7:30 PM, Online
Learning Outcome: 1, 2, 3, 5, 10

Test 1 is closed book but one A4 crib sheet (double page) is allowed.

Midterm 2 (20%)
Date: Sat, Nov 18, 9:00 AM - 10:30 AM, Online
Learning Outcome: 1, 2, 3, 5, 10
Test 2 is closed book but one A4 crib sheet (double page) is allowed.

Final Exam (50%)
Date: Thu, Dec 7, 08:30 AM - 10:30 PM, face to face
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
Final exam date and time are subject to change. Please see Webadvisor for the most up to date information.

_____

7 Course Statements

7.1 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Learning

Graduate Attribute	Objectives	Assessment
1. Knowledge Base	all	all
5. Use of Engineering Tools	7	tutorials
6. Communication	all	tutorials

7.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information

on regulations and procedures for Academic
Consideration of Religious Obligations:
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-
accomrelig.shtml

Missed midterm: If you miss a midterm exam the weight of the midterm will be shifted to the
final exam.
No extra time will be given to students who arrive late to assessments..

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning
for a variety of students. Selected lecture notes will be made available to students on
Courselink but these are not intended to be stand-alone course notes. Some written lecture
notes will be presented only in class. During lectures, the instructor will expand and explain
the content of notes and provide example problems that supplement posted notes.
Scheduled classes will be the principal venue to provide information and feedback for tests
and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during
lectures and lab sessions. Students, especially those having difficulty with the course content,
should also make use of other resources recommended by the instructor. Students who do
(or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the
instructor informed. This will allow the instructor to recommend extra resources in a timely
manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the
School: faculty, staff and students. As a student in a lab course you are responsible for taking
all reasonable safety precautions and following the lab safety rules specific to the lab you are
working in. In addition, you are responsible for reporting all safety issues to the laboratory
supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly:
e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or
compassionate reasons please advise the course instructor (or designated person, such as a

teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

https://www.uoguelph.ca/academics/calendars

9.9 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

_____