UNIVERSITY of GUELPH

ENGG*1500 Engineering Analysis

01

Winter 2020
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 1.00 - January 05, 2020

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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

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 associated software tools (MATLAB) and to give you exposure to real problems that you will encounter throughout your engineering career.

1.3 Timetable

Times and room locations are subject to change. Please see WebAdvisor for the latest information.

1.4 Final Exam

Date & Time, 8:30 PM - 10:30 PM, 2020/04/06, Room TBA. Final exam time and location is subject to change. Please see Webadviser for the latest information.

Final exam will be closed-book. NO CALCULATORS are permitted. A formula sheet will be provided.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Julie Vale
Email: jvale@uoguelph.ca
Telephone: +1-519-824-4120 x54863
Office: THRN 2340

2.2 Teaching Assistants

Teaching Assistant: Valerie Bauman
Email: vbauman@uoguelph.ca

Teaching Assistant: Shashank Shekhar
Email: sshekhar@uoguelph.ca

Teaching Assistant: Syeda Manjia Tahsien
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Teaching Assistant: Timothy Wong
Email: twong05@uoguelph.ca

Teaching Assistant: Arash Yoosefdoost
Email: arashyd@uoguelph.ca

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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 daily.

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

3.2 Communication and Email Policy

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

It is your responsibility to abide by the following guidelines for all email correspondence:

- Send all emails from your uoguelph.ca e-mail account.
- Include the course code "ENGG*1500" in the subject line of all emails.
- Use a professional tone and appropriate etiquette in all your correspondence. This includes addressing the email using the correct salutation (correct name and correct title).
- Before emailing a GTA or the instructor with a question, check the course outline and Courselink announcements/newsfeed to see if your question has already been answered there.

Failure to follow these guidelines may result in your email being disregarded.

Important: Unprofessional emails will not be responded to. This includes those using l33t, text messaging shorthand, a complete lack of punctuation or capitals, etc. Furthermore, Miss., Mrs., Ms., and Mr. are inappropriate forms of address for any staff or faculty member who has a PhD. When communicating with a course instructor, (verbally or via email), please use Julie, Dr. Vale, or Professor

Emails using Miss., Mrs., or Ms. will not be responded to.

For all correspondence satisfying the above guidelines, the instructor and TAs will abide by the following guidelines:

- Respond to questions within 24 hours on weekdays. Do not expect replies on evenings, holidays, or weekends.
- Use a professional tone and appropriate etiquette in all correspondence

Occasionally, an email may get missed, especially during busy times in the term. If you have not received a timely reply and you are confident that you have abided by all of the guidelines above, we apologize. Please resend your email and we will try to respond to it immediately.

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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
5	Use of Engineering Tools	10
5.1	Select appropriate engineering tools from various alternatives	10
5.2	Demonstrate proficiency in the application of selected engineering tools	10
5.3	Recognize limitations of selected engineering tools	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 3-6 - Solving systems of linear equations (SLE):** row echelon form, existence and uniqueness, homogeneous and general forms, irrigation and chemical balance applications
- **Lectures 7-9 - Spaces:** Subspace and vector spanning, bases, dimensions, rank,

columnspace, null space, sensor mapping application
- **Lecture 10 - Midterm 1 review**
- **Lectures 11-12 - Additional Matrix concepts:** matrix multiplication, determinant, inverse.
- **Lectures 13-17 - Eigenvalues and eigenvectors:** complex number algebra, characteristic polynomial, eigenspaces, algebraic and geometric multiplicity, Principal Component Analysis application (part 1)
- **Lecture 18 Midterm 2 review**
- **Lectures 19-21 - Coordinates:** Norm, projection/perpendicular, dot product, orthonormal vectors, Principal Component Analysis application (part 2)
- **Lectures 22-23 - Diagonalization:** Matrix diagonalization, Markov application
- **Lecture 24 - Final exam review**

5.2 Lab/tutorial schedule

There are no labs in week 1 (Jan 6).

Labs run in alternate weeks, starting in week 2 (Jan.13).

If you are in lecture **section 1** (2:30-4pm lectures), you will attend the lab in **even** weeks (weeks 2,4,6,8,10). If you are in lecture **section 2** (10-11:30am lectures), you will attend the lab in **odd** weeks (weeks 3,5,7,9,11).

Reading week (Feb 17) does not count as a week.

Week 12 (March 30) will be used as a make-up week

Due to space/safety constraints, you must attend your scheduled lab time/date.

5.3 Other Important Dates

Please see the schedule of dates for other important dates in the academic year: https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/index.shtml
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6 Assessments

6.1 Marking Schemes & Distributions

Assessment of your final grade will be evaluated against four different assessment schemes as described in the table below with your **final grade assigned being the maximum calculated by the four schemes**.   These schemes allows students who performed poorly on one or both midterms to diminish the weight of the midterm(s) by putting more weight on the final .

Following the weightings shown in the schemes below, this overall exam grade can be calculated as follows

Exam = (1/0.85) * max(0.20 midterm 1 +0.20 midterm 2 + 0.45 final,
0.20 midterm 1 +0.15 midterm 2 + 0.50 final,
0.15 midterm 1 +0.20 midterm 2 + 0.50 final,
0.15 midterm 1 +0.15 midterm 2 + 0.55 final)

If you fail the exam portion of the course (i.e., Exam<50%), you will receive a failing grade in the course equal to the highest of the possible exam weightings; i.e., your course grade will be Exam as calculated above.

Name	Scheme A (%)	Scheme B (%)	Scheme C (%)	Scheme D (%)
Quizzes	5	5	5	5
Tutorials and Matlab labs	10	10	10	10
Midterm 1	20	20	15	15
Midterm 2	20	15	20	15
Final	45	50	50	55
Total	100	100	100	100

6.2 Assessment Details

Quizzes (0%)
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Quizzes: Quizzes are held in the first 5 - 10 minutes of every tutorial. These are tightly timed quizzes with no calculators allowed that are designed to help you improve your linear algebra/mental math calculation skills. No extra time will be given to students who arrive late. If you typically write tests with SAS, please contact the instructor to discuss alternate options.

Tutorials and Matlab labs (0%)
Learning Outcome: 1, 3, 4, 6, 7, 8, 9, 10
There are five (5) tutorial/labs. Attendance will be taken at tutorials. Grades are allocated based on a combination of submitted worksheets and in-lab assessment of MATLAB codes. Please see courselink for guidelines and expectations for each lab. Please attend your assigned tutorial section. A makeup session will be available in the last week of class.

Midterm 1 (0%)
Date: Thu, Feb 6, 5:30 PM - 7:00 PM, ROZH 104
Learning Outcome: 1, 2, 3, 5, 10
Midterm is closed book, no calculators allowed.

Midterm 2 (0%)
Date: Thu, Mar 12, 5:30 PM - 7:00 PM, ROZH 104

Learning Outcome: 1, 2, 3, 5, 10
Midterm is closed book, no calculators allowed.

Final Exam (0%)
    Date: Mon, Apr 6, 8:30 AM - 10:30 AM, TBD (check webadvisor)
    Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
    Final is closed book, no calculators allowed.

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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 due to grounds for granting academic consideration,

please contact the instructor. If your documentation is adequate, the weight of the midterm will be moved to the final exam.

No extra time will be given to students who arrive late to any of these assessments.

Missed labs/tutorials: If you miss a lab/tutorial due to grounds for academic or religious consideration, you must contact the instructor **before** the missed lab, in which case you will be allowed to make-up the lab (additional details below). If you do not contact the instructor before your scheduled lab slot, you will receive a grade of zero. In extenuating/extreme circumstances, notification of absence *after* the lab is acceptable - the instructor determines what constitutes extenuating/extreme circumstances.

To make-up ONE lab/tutorial, you must attend the tutorial sessions during the makeup week (week of March 30).

To make-up additional labs, you must provide documentation of the reasons for your absences. If this documentation is adequate, you will be asked to arrange a make-up time with one of the GTAs. If the documentation is not adequate, you will receive a grade of zero.

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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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

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