

MATH 115 – Fall 2018

Linear Algebra for Engineering

Course Description: This is a course on linear algebra and its applications to engineering. Topics to be covered include complex numbers; vectors, lines and planes; systems of linear equations; matrices, linear transformations and determinants; introduction to vector spaces; eigenvalues, eigenvectors and diagonalization; the Gram-Schmidt algorithm and orthogonal diagonalization; Singular value decomposition (time permitting). We approach the material through a blend of theoretical ideas, computational methods and some applications.

Textbook: Kenneth Hardy, *Linear Algebra for Engineers and Scientists*.

Website: Announcements, the course schedule and other important information will be available on [LEARN](#). Students are expected to visit this website at least once per day.

Grading Scheme: Assignments – 10% Quizzes – 5% Midterm Exam – 25% Final Exam – 60%

Tentative Course Schedule					
Week	Dates	Topic	Text	Due	Notes
0	Sep 6–7	Course Introduction and Complex Numbers	8.1, 8.2		
1	Sep 10–14	Complex Numbers, Vectors in \mathbb{R}^n	8.3, 8.4, 3.1	Assignments 0,1	
2	Sep 17–21	Dot Product, Norm, Cross Product, Lines and Planes, Projections	4.1, 8.5	Assignment 2	
3	Sep 24–28	Systems of Linear Equations	1.1, 1.2	Assignment 3	
4	Oct 1–5	Applications of Linear Systems of Equations, Matrix Algebra	2.1	Quiz 1	
5	Oct 8–12	Applications of Matrix Multiplication	lecture notes	Assignment 4	No lectures on Monday, Tuesday, and Wednesday. Thursday follows a Tuesday schedule, Friday follows a Wednesday schedule
6	Oct 15–19			Midterm	Midterm Week: No Classes
7	Oct 22–26	Matrix Algebra, Matrix Inverses, Linear Mappings	2.1, 2.2, 3.4		
8	Oct 29 – Nov 2	Geometric Transformations, Inverse Mappings, Vector Spaces, Subspaces and Spanning Sets	3.4, 7.1	Assignment 5	
9	Nov 5–9	Linear Independence, Basis, Dimension	3.2, 3.3, 7.2, 7.3	Quiz 2	
10	Nov 12–16	Determinants and Matrix Inverses, Polynomial Interpolation	5.1, 5.2	Assignment 6	
11	Nov 19–23	Eigenvalues and Eigenvectors, Diagonalization	6.1, 6.2	Quiz 3	
12	Nov 26–30	Orthogonal Bases, Gram-Schmidt Algorithm, Orthogonal Diagonalization (time permitting)	4.2, 4.3	Assignment 7	
13	Dec 3	Singular Value Decomposition (time permitting)	lecture notes		

* As different sections of MATH 115 follow different weekly schedules, this schedule is not precise. More explicit information on which sections of the book are covered will be provided with each assignment.

Assignments: There will be 8 assignments, numbered 0 through 7. Only the best 7 assignments (equally weighted) will count towards your final mark.

Assignments must be scanned and submitted electronically. Instructions will be provided and students are expected to follow them carefully. No late submissions will be accepted, regardless of circumstances.

The first assignment (Assignment 0) is due for marks at 5:00pm on Monday, September 10, 2018. It contains two easy questions and is designed to get you familiarized with the Crowdmark submission process.

The remaining assignments are due on Fridays at 8:30am with the exception of the midterm week, the week after reading week and any week in which there is a Quiz.

Your assignment solutions should be legible, detailed and well-organized. In particular, they should not be a mess of scribbles and formulas that forces the grader to try to guess what you were doing.

Assignments will normally be available at least one week before they are due and solutions will be posted on LEARN shortly after the submission deadline. Our goal is to provide you with your grade and feedback within one week of the submission deadline.

While you are encouraged to work together to solve the assignment problems, the solutions that you submit must be your own work and so should be written up without any consultation with your colleagues. Do not look up full or partial solutions on the internet or in printed sources.

Quizzes and Tutorials Sections: There will be 3 quizzes held during the semester that will be written in the Tutorial (TUT) section to which you are enrolled. Only the 2 best quizzes will count towards your quiz mark. There will be no make-up quizzes under any circumstances. Quizzes written in the wrong room will receive a grade of zero. You are required to bring your student ID to the quiz and no aids of any kind are permitted during quizzes. Note that in the weeks when there are no quizzes, your Tutorial section will be a regular tutorial where the TA will have students work on selected problems, take up their solutions, and offer assistance with homework if time permits. The Tutorial sections will begin on the week of September 10, 2018.

Midterm Exam: The midterm examination will be held on Thursday, October 18, 2018 from 6:30pm – 8:20pm (110 minutes). You are required to bring your student ID to the midterm. No aids are of any kind permitted during the midterm exam. More information regarding this exam will appear later in the semester.

Final Exam: A 2.5 hour final examination will be scheduled by the Registrar’s Office during the examination period from Thursday, December 6 to Friday, December 21, 2018. Students are expected to be present during the final exam period.

Missed Exams and Quizzes: If you become seriously ill and are forced to miss an exam or a quiz, you must immediately contact the [First Year Engineering Office](#) and tell them about your condition. You must also promptly provide a medical certificate. If the midterm is missed (with proper documentation), we will normally assign a weight of 85% to your final exam. If the final exam is missed (with proper documentation) and you have obtained a grade of at least 20 out of the possible 40 marks available throughout the assignments, quizzes and midterm, then you are eligible for an [INC grade](#).

Extra Help: You have several options as to where to seek help with the course material. Your instructor will hold weekly office hours and the TUT section that you are enrolled in will be treated as a drop-in help session on the weeks when there are no quizzes. Also, you may drop in to the WEEF TA Office in E2 1786 between the hours of 8:30am to 8:30pm Monday through Friday (a schedule of when Linear Algebra help is specifically available will be posted on LEARN when it is available).

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. Check the [Office of Academic Integrity](#) for more information.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70, Student Petitions and Grievances, Section 4](#). When in doubt please be certain to contact the department’s administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to [Policy 71, Student Discipline](#). For typical penalties check [Guidelines for the Assessment of Penalties](#).

Appeals: A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances](#) (other than a petition) or [Policy 71, Student Discipline](#) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to [Policy 72, Student Appeals](#).

Note for Students with Disabilities: [AccessAbility Services](#), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations

to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

Lecture Information						
Section	Time and Location			Instructor	Email	Office
LEC 001	MWF Th F	11:30am – 12:20pm 3:30pm – 4:20pm 1:30pm – 2:20pm ¹	RCH 301	Patrick Roh	proh@uwaterloo.ca	MC 6494
LEC 002	MF Tu W Tu	8:30am – 9:20am 1:30pm – 2:20pm 10:30am – 11:20am 12:30pm – 1:20pm ²	E7 5353	Matthew Harris	m33harri@uwaterloo.ca	MC 6323
LEC 003	MWF Th Tu	2:30pm – 3:20pm 3:30pm – 4:20pm 9:30am – 10:20am ²	E7 5353	Abdulmajid Osumanu	a3osuman@uwaterloo.ca	MC 6331
LEC 004	M TuTh W W	2:30pm – 3:20pm 1:30pm – 2:20pm 12:30pm – 1:20pm 8:30am – 9:20am ³	E7 5343	Justin Shaw	j9shaw@uwaterloo.ca	MC 6119
LEC 005	MW Tu F W	11:30am – 12:20pm 1:30pm – 2:20pm 11:30am – 12:20pm 12:30pm – 1:20pm ⁴	DWE 2402 DWE 2402 DC 1351 RCH 302	Mukto Akash	makash@connect.uwaterloo.ca	MC 6508
LEC 006	MTuW F Tu	3:30pm – 4:20pm 11:30am – 12:20pm 2:30pm – 3:20pm ⁵	RCH 302 DC 1351 RCH 302	Mukto Akash	makash@connect.uwaterloo.ca	MC 6508
LEC 007*	MTuWF Tu	2:30pm – 3:20pm 3:30pm – 4:20pm ⁵	RCH 103	Ryan Trelford	r2trelfo@uwaterloo.ca	MC 6514
LEC 008**	MTuWF Tu	9:30am – 10:20am 10:30am – 11:20am ⁵	RCH 103	Ryan Trelford	r2trelfo@uwaterloo.ca	MC 6514
LEC 009	MWF Th M	9:30am – 10:20am 9:00am – 9:50am 3:30pm – 4:20pm ⁶	RCH 112	Laurent Poirrier	lpoirrier@uwaterloo.ca	MC 6318
LEC 010	MWF Th Th	3:30pm – 4:20pm 2:30pm – 3:20pm 3:30pm – 4:20pm ⁷	MC 1085	Isam Al-Darabsah	ialdarabsah@uwaterloo.ca	MC 6427

¹September 21, November 2 and November 23 only

²September 25, October 23 and November 13 only

³September 26, October 24 and November 14 only

⁴September 19, October 31 and November 21 only

⁵September 18, October 30 and November 20 only

⁶September 17, October 29 and November 19 only

⁷September 13, October 25 and November 15 only

*Friday lectures on September 21 and 28 are cancelled for LEC 007. Instead, lectures will be held on Thursday September 20 and Thursday September 27 at 5:30pm – 6:20pm in RCH 103.

**Friday lectures on September 21 and 28 are cancelled for LEC 008. Instead, lectures will be held on Thursday September 20 and Thursday September 27 at 4:30pm – 5:20pm in RCH 103.