Course Outline

Bachelor of Science in Engineering

Winter, 2016

MATH 102: Applied Linear Algebra
3 Credits, 16 weeks, 3 hours lecture, 1 hour lab

This course covers vector and matrix algebra, systems of linear equations, vector geometry in the plane and in space, determinants, orthogonality and applications, eigenvalues and eigenvectors with applications, complex vector spaces. The course will also introduce students to the use of the computer algebra system MATLAB in solving problems in Linear Algebra.

Prerequisites and/or co-requisites: MATH 100

Instructor

Instructor Name: Matthew Morin
Office location: S211E
Phone number: 780-791-4831
matthew.morin@keyano.ca

Office Hours

Monday	14:00 – 16:00
Tuesday	10:00 – 11:00
Wednesday	10:00 – 11:00
Thursday	14:00 – 15:00

Hours of Instruction

Monday	16:00 – 17:00 Lab (S214)
Wednesday	15:00 – 16:00 (S210)
Thursday	13:00 – 14:00 (S205)
Friday	15:00 – 16:00 (S205)

Required Resources

Elementary Linear Algebra, Applications Version, Howard Anton, Chris Rorres, 11th edition, ISBN 978-1-118-43441-3

Course Outcomes

The student will be able to:

- Perform basic algebraic operations with matrices and vectors (addition, scalar multiplication, products).
- Use vectors and matrices to represent equations, geometrical relationships, transformations, and other concepts.
- Row reduce a matrix to its row reduced echelon form and use this form to solve linear equations, test independence, determine fundamental matrix spaces, and solve other matrix problems.
- Compute the determinant of a matrix and use it to determine properties of the matrix.
- Determine a basis for a given space/subspace and create a set of coordinates with respect to this basis.

- Determine the fundamental spaces associated with a matrix (row space, column space, null space, eigenspace) and describe the relationships between the geometry of these spaces.
- Determine whether or not a given matrix is diagonalizable, and—if it is—determine a diagonalization.
- Use the Gram-Schmidt process to determine an orthogonal (or orthonormal) basis of an inner product space and use this basis to perform projections.

Evaluation

Assignments	10%
Lab Assignments	5%
Midterm Exam	40% (two exams, 20% each)
Final Exam	45%
Total	100%

A grade of C- is required for progression or transfer.

Grading System

Descriptor	Alpha Grade	4.0 Scale	Percent	Rubric for Letter Grades
Excellent	A+	4.0	> 92.9	Work shows in-depth and critical analysis, well developed ideas, creativity, excellent writing, clarity and proper format.
	A	4.0	85 – 92.9	
	A-	3.7	80 – 84.9	
Good	B+	3.3	77 – 79.9	Work is generally of high quality, well developed, well written, has clarity, and uses proper format.
	B	3.0	74 – 76.9	
	B-	2.7	70 – 73.9	
Satisfactory **Progression**	C+	2.3	67 – 69.9	Work has some developed ideas but needs more attention to clarity, style and formatting.
	C	2.0	64 – 66.9	
	C-	1.7	60 – 63.9	
Poor **Minimum Pass**	D+	1.3	55 – 59.9	Work is completed in a general way with minimal support, or is poorly written or did not use proper format.
	D	1.0	50 – 54.9	
Failure	F	0.0	< 50	Responses fail to demonstrate appropriate understanding or are fundamentally incomplete.

Proposed Schedule of Topics

Week	Dates	Topic	Chapter Sections
1	Jan. 4 - Jan. 8 (No Classes Jan. 4)	Introduction, Matrix Operations, Systems of Equations	1.1, 1.2, 1.3
2	Jan. 11 - Jan. 15	Gaussian Elimination, Inverses	1.4, 1.5
3	Jan. 18 - Jan. 22	Properties of Systems and Matrices, Determinants	1.6, 2.1, 2.2
4	Jan. 25 - Jan. 29	Cramer's Rule, Euclidean Space	2.3, 3.1, 3.2

Week	Dates	Topic	Chapter Sections
5	Feb. 1 - Feb. 5	Dot Product, Cross Product, Geometry of Linear Systems	3.3, 3.5, 3.4
6	Feb. 8 - Feb. 12	**Midterm 1**, Vector Spaces	3.4(cont.), 4.1
7	Feb. 15 - Feb. 19 (No Classes on Monday—**Family Day**)	Subspaces, Independence	4.2, 4.3
	Feb. 22 - Feb. 26	**Reading Week**	
8	Feb. 29 – Mar. 4	Coordinates, Dimension	4.3(cont.), 4.4, 4.5
9	Mar. 7 – Mar. 11	Change of Basis, The Fundamental Spaces of a Matrix, Rank Equation	4.6, 4.7, 4.8
10	Mar. 14 – Mar. 18	Matrix Transformations (Linear Transformations)	4.9, 4.10
11	Mar. 21 – Mar. 25 (No Classes on Friday—**Good Friday**)	Eigenvalues/Eigenvectors, Diagonalization	5.1, 5.2, 5.3
12	Mar. 28 – Apr. 1 (No Classes on Monday—**Easter Day**)	**Midterm 2** Inner Products	3.3(cont.), 6.1
13	Apr. 4 – Apr. 8	Orthogonality,Gram-Schmidt Process	6.2, 6.3
14	Apr. 11 – Apr. 15	Orthogonal Matrices, Orthogonal Diagonalization, Linear Transformations	7.1, 7.2
	Apr. 18 – Apr. 22	**Exam Period**	

Please Note:
Date and time allotted to each topic is subject to change. It is your responsibility as a student to contact the Office of the Registrar to complete the forms for Withdrawal or Change of Registration, and any other forms. Please refer to the list of important dates as noted in the Academic Schedule in the Keyano College Credit Calendar.

Performance Requirements

Assignments:

In any mathematics course the best way “to learn” is “to do.” The instructor can teach you about the course ideas and demonstrate the mechanics of solving the problems—and can make it look very easy—but growing adept at solving these problems will take a lot of practice and can be a struggle. Although the assignments do not count for a large part of your final grade they are essential in preparing you for the types of problems you will be solving on the exams.

The assignments should be typed or written neatly, stapled, and handed in on the assigned due date. A cover page is not required, but the assignment should show the assignment number, the course number, and the student’s name (printed, not written). The problems should be solved in the order given. A late assignment may be accepted, or may incur a penalty.

Although you may work with other students while completing assignments, it is essential that the work you present is your own—see the section on academic misconduct below. Using other students solutions as your own may result in serious academic penalties. If you work with other students on assignment problems, be sure that you know how to solve the problems and that you write out your own solutions in your own words.

Tests:

All tests will be written and are closed-book. No calculators are allowed, nor should they be needed. The topics covered by each test will be described in advance in-class and these details will be

posted on Moodle. These tests are meant to test how well you have "mastered" the subject matter. Satisfactory completion of the relevant assignment problems, reading the relevant textbook sections, and studying the course notes is the very minimum amount of work that should prepare you for the types of problems that could appear on a test. However, as tests are cumulative, you may be solving problems that require ideas that bridge across several sections of the course.

Student Attendance

Class attendance is useful for two reasons. First, class attendance maximizes a students' learning experience. Second, attending class is a good way to keep informed of matters relating the administration of the course (e.g., the timing of assignments and exams). Ultimately, you are responsible for your own learning and performance in this course.

It is the responsibility of each student to be prepared for all classes. Students who miss classes are responsible for the material covered in those classes and for ensuring that they are prepared for the next class, including the completion of any assignments and / or notes that may be due.

Academic Misconduct

Students are considered to be responsible adults and should adhere to principles of intellectual integrity. Intellectual dishonesty may take many forms, such as:

- Plagiarism or the submission of another person's work as one's own
- The use of unauthorized aids in assignments or examinations (cheating)
- Collusion or the unauthorized collaboration with others in preparing work
- The deliberate misrepresentation of qualifications
- The willful distortion of results or data
- Substitution in an examination by another person
- Handing in the same unchanged work as submitted for another assignment
- Breach of confidentiality.

The consequences for academic misconduct range from a verbal reprimand to expulsion from the College. More specific descriptions and details are found in the Student Rights and Student Code of Conduct section of the Keyano College 2015-2016 credit calendar. It is the responsibility of each student to be aware of the guidelines outlined in the Student Rights and Student Code of Conduct Policies.

In order to ensure your understanding of the concept of plagiarism, you must successfully complete the online tutorial found at http://ilearn.keyano.ca/. Then print the certificate, sign it, and show it to each of your instructors. Your course work will not be graded until you show this signed certificate.

Specialized Supports

Counselling and Disability Services
Counselling Services provides a wide range of specialized counselling services to prospective and registered students, including personal, career and academic counselling.

SKILL Centre
The SKILL Centre is a learning space in the Clearwater Campus at Keyano College where students can gather to share ideas, collaborate on projects and get new perspectives on learning from our tutorial staff.

The SKILL Centre, through a variety of delivery methods, provides assistance in skill development to Keyano students. Assistance is provided by instructors, staff and student tutors. Individuals wishing to improve their mathematics, writing, grammar, study, or other skills, can take advantage of this unique service.

Authorization

This course outline has been reviewed and approved by the Program Chair.

Matthew Morin, Instructor

Louis Dingley, Chair — Date Authorized

Guy Harmer, Dean — Date Authorized

Signed copies to be delivered to:
Instructor
Registrar's Office