MATH 310: ELEMENTARY LINEAR ALGEBRA (SPRING 2015)

Course number: MAT 310-01

Course title: Elementary Linear Algebra

Credits: 3

Meetings: MWF 12:00–12:50 PM, Petty 223

Prerequisites: Grade of C or better in MAT 292

Instructor information:

Instructor: Dr. Dan Yasaki `d_yasaki@uncg.edu`
Homepage: `http://www.uncg.edu/math/faculty/d_yasaki/teaching.html`
Office Hours (146 Petty): MWF 10:00–11:00 AM

For whom planned: Mathematics majors and minors

Catalog description: Linear systems, matrices, determinants, eigenvalues and eigenvectors, finite-dimensional vector spaces, linear transformations.

Student learning outcomes: Upon successful completion of this course students shall be able to

- **SLO 1: define** basic terms associated with Linear Algebra, such as linear systems, linear transformations, matrices, linear independence, dimension, rank, null space, basis, vector space, eigenvalues/eigenvectors and orthogonality;
- **SLO 2: give examples** of spaces, linear maps or matrices exhibiting properties outlined in SLO 1 in addition to examples of diagonal matrices, invertible matrices, change of bases, and other topics;
- **SLO 3: explain** definitions and give precise statements of important theorems of Linear Algebra; and
- **SLO 4: construct** and **defend** coherent mathematical proofs of statements in Linear Algebra based on definitions and previous theorems.

Teaching methods and assignments for achieving learning outcomes:

- **Reading:** Reading the sections we discuss before class is essential if you wish to get the most out of lectures. This allows you to form questions before you see me present the material so that you can focus on the confusing aspects of the topics we discuss. (SLO 1)
- **Lectures:** This is the primary method of content delivery. I plan to follow the book closely, but I will supplement the book's material with some of my own when questions arise or when I feel it is appropriate. (SLO 1–3)
- **Quizzes:** There will be short weekly quizzes where you should expect one or two problems – one asking you to state a definition or result and the second asking you to apply that definition or result in some way. (SLO 1–3)
- **Tests:** Tests serve as the primary gauge of evaluation. (SLO 1–4)

This document was last modified on April 6, 2015.

Homework: Homework is the most important way to actually "learn" mathematics. This is the same sort of practice that is used to learn to play tennis or learn to play the piano. One cannot learn these things by watching them on television or reading about them in a book no more than one can learn mathematics by watching a lecture or reading a mathematics book. (SLO1–4)

Evaluation and grading: Semester averages are rounded to the nearest point, and letter grades are assigned on a 10 point scale.

A+ : 97–100	B+ : 87–89	C+ : 77–79	D+ : 67–69	
A : 93–96	B : 83–86	C : 73–76	D : 63–66	F : 0 – 59
A− : 90–92	B− : 80–82	C− : 70–72	D− : 60–62	

Homework: Homework will be collected often. All assignments are weighted equally. Homework counts for 12.5% of your final grade. Due dates are posted on website.

Quizzes: There will be a weekly quiz. All quizzes are weighted equally. Quizzes count for 12.5% of your final grade.

Tests: Three tests count 15% of your grade each. The final exam counts for 30% of your final grade.

(1) Test 1 (Monday, February 9)
(2) Test 2 (Monday, March 23)
(3) Test 3 (Monday, April 27)
(4) Final exam (Friday, May 1, noon–3 PM)

Required text:

Lay, David C. *Linear Algebra and its Applications,* 4th ed., Pearson, 2012. ISBN 13: 978-0-321-38517-8.

Academic Integrity Policy: Each student is required to sign the Academic Integrity Policy on all major work submitted for the course.

I have abided by the UNCG Academic Integrity Policy on this assignment.
Signature _____ Date _____

More information can be found at

`http://sa.uncg.edu/handbook/academic-integrity-policy/`.

Attendance Policy: Attendance is mandatory. Two consecutive absences or four total absences during the semester may result in a failing grade, regardless of semester average. Attendance will be measured using quizzes.

Additional information:

(1) UNCG seeks to comply fully with the Americans with Disabilities Act (ADA). Students requesting accommodations based on a disability must be registered with the Office of Accessibility Resources and Services (OARS) in 215 Elliott University Center, 334-5440, `http://oars.uncg.edu`.
(2) Assignments Policy: Assignments are due at the beginning of class. Late assignments will not be accepted.
(3) Absence Policy: You are responsible for all missed material. Any missed assignment, test, or final exam will result in a score of 0. Make-up tests and final exam will be

given only if you receive prior approval for a valid excuse by contacting me at least one week in advance.

(4) Copyright Policy: Selling or purchasing notes from classes for commercial gain is a violation of the UNCG Copyright Policy.

`http://policy.uncg.edu/copyright/`

Any student who sells notes taken in class for commercial gain, or who purchases notes taken by another student for commercial gain, is in violation of this policy and, by extension, is committing a violation of the Student Code of Conduct.

`http://sa.uncg.edu/handbook/student-code-of-conduct/`

(5) Email Policy: All email correspondence should be made using your UNCG email account. You must check your email regularly for updates and announcements.

(6) Calculators are not allowed on tests, quizzes, or the final exam. There will be homework exercises that require the use of MATLAB or similar software.

Tentative Calendar					
Week of		Topics			Notes
1	1/12	1.1	1.2	1.3	Last day to adjust schedule: Friday
2	1/19	—	1.4	1.5	MLK Monday
3	1/26	1.7	1.8	1.9 (1.10)	
4	2/2	2.1	2.2–2.3	Review	
5	2/9	Test 1	2.8	2.9	**Test 1** (1.1–2.3): Monday
6	2/16	3.1, 3.2	3.3	4.1	
7	2/23	4.2	4.3	4.4	
8	3/2	4.5	4.6	Review	Last day to withdraw: Friday
9	3/9	—	—	—	Spring Break
10	3/16	4.7	4.9	Review	
11	3/23	Test 2	5.1	5.2	**Test 2** (2.8–4.9): Monday
12	3/30	5.3	5.4	—	Spring Holdiay
13	4/6	Review	5.5	5.6	
14	4/13	6.1	6.2	6.3	
15	4/20	6.5	6.6	Review	
16	4/27	Test 3	Reading Day	Final Exam	**Test 3** (5.1–6.6): Monday Last day Tuesday **Final Exam** (1.1–6.6): Friday, noon

1.	**Linear Equations in Linear Algebra**
1.1	Systems of Linear Equations (1–4, 8, 10, 12, 20-25)
1.2	Row Reduction and Echelon Forms (2–16 (even), 20–27, 30, 31)
1.3	Vector Equations (8, 12–16 (even), 22–25)
1.4	The Matrix Equation $A\mathbf{x} = \mathbf{b}$ (2–20 (even), 23, 24–32 (even))
1.5	Solution Sets of Linear Systems (2–14 (even), 23-26, 28–36 (even), 37)
1.7	Linear Independence (2–20 (even), 21–30, 34, 38)
1.8	Introduction to Linear Transformations (4, 6, 9, 10, 13–16, 18, 20, 21–24)
1.9	The Matrix of a Linear Transformation (2, 4, 16, 23–27, 31–36)
1.10	Linear Models in Business, Science, and Engineering (1, 2, 9, 10, 12)
2.	**Matrix Algebra**
2.1	Matrix Operations (6–12 (even), 13, 15, 16, 18–22, 28, 29, 32)
2.2	The Inverse of a Matrix (8–11, 12–24 (even), 35)
2.3	Characterization of Invertible Matrices (2–10 (even), 11–14, 18–25)
2.8	Subspaces of $\mathbb{R}^n$ (2–8 (even), 16, 18, 20–22, 24, 26)
2.9	Dimension and Rank (2–16 (even), 17, 18, 22, 24, 25, 27)
3.	**Determinants**
3.1	Introduction to Determinants (2–8 (even), 16–26 (even), 34, 39, 40)
3.2	Properties of Determinants (2–10 (even), 16, 18, 22, 27, 28, 31, 35)
3.3	Cramer's Rule, Volume, and Linear Transformations (20, 22, 26–32)
4.	**Vector Spaces**
4.1	Vector Spaces and Subspaces (2–18 (even), 23, 24, 32, 33)
4.2	Null Spaces, Column Spaces, and Linear Transformations (4–24 (even), 25, 26, 32, 33, 34*, 35*)
4.3	Linearly Independent Sets; Bases (2–8 (even), 12, 16, 21–25, 31, 32*)
4.4	Coordinate Systems (2, 4, 12, 15–17, 23, 24, 28, 31*, 33*)
4.5	The Dimension of a Vector Space (4–12, 18, 19, 20, 24, 29, 30, 34)
4.6	Rank (2, 4, 5–16 (even), 17, 18, 20, 28, 30, 34*)
4.7	Change of Basis (6, 8, 11, 12, 14, 17*, 18*)
4.9	Applications to Markov Chains (2, 3, 6, 10, 12, 16)
5.	**Eigenvalues and Eigenvectors**
5.1	Eigenvectors and Eigenvalues (2, 4, 6, 14, 20, 21, 22, 31, 32)
5.2	The Characteristic Equation (2, 8, 10, 19, 20, 21, 22, 24)
5.3	Diagonalization (2, 4, 8, 12, 21, 22, 31, 32)
5.4	Eigenvectors and Linear Transformations (2, 4, 10, 12, 20, 25, 26, 30)
5.5	Complex Eigenvalues (2, 6, 12, 14, 23, 24)
5.6	Discrete Dynamical Systems (1, 2, 3, 5, 10, 17)
6.	**Orthogonality and Least Squares**
6.1	Inner Product, Length, and Orthogonality (2–14 (even), 19–30)
6.2	Orthogonal Sets (2–16 (even), 23–29, 31, 33)
6.3	Orthogonal Projections (2–14 (even), 21–24)
6.5	Least-Squares Problems (2–14 (even), 17–19)
6.6	Applications to Linear Models (1–5, 8a, 10, 13)