MATH-UA 140: LINEAR ALGEBRA
SYLLABUS - SPRING 2015

Instructor: Drew C. Youngren, Ph.D.

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Office: Courant Institute (Warren Weaver Hall) Rm. 721

Office Hours: T 1230–1430, R 1530–1730

Lecture:
- Section 002: GCASL rm. 361 - MW 1230–1420
- Section 005: GCASL rm. 361 - MW 1530–1720

Course description: [1] Linear algebra is an area of mathematics devoted to the study of structure-preserving operators on special sets (linear operators on vector spaces). Linear algebra is a cornerstone of any mathematics curriculum for two very important (and related) reasons: 1) The theory of linear algebra is well understood and so a first step in many areas of applied mathematics is to reduce the problem into one in linear algebra. 2) The spaces and operations studied in the subject are commonplace in many different areas of mathematics, science, and engineering.

Over the semester we will study many topics that form a central part of the language of modern science:
- Formulate, solve, apply, and interpret systems of linear equations in several variables;
- Compute with and classify matrices;
- Master the fundamental concepts of abstract vector spaces;
- Decompose linear transformations and analyze their spectra (eigenvectors and eigenvalues);
- Use length and orthogonality in each of the above contexts.
- Other topics as time permits.

The material we take up in this course has applications in physics, chemistry, biology, environmental science, astronomy, economics, statistics, and just about everything else. We want you to leave the course not only with computational ability, but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical beauty and power.

Textbook:
- Lay, David C. *Linear Algebra and its Applications.* 4th Edition.

Grading: The final grade will be computed with the following weights:

Homework	20%
Quizzes	20%
Midterm Exams	35%
Final Exam	25%

A note on grades of W and I.

You may drop the course in the first three weeks (by Monday, February 10) without it appearing on your transcript. After that, and through the ninth week, you may withdraw and receive a grade of 'W' on your transcript. No withdrawals are granted after the ninth week.

A grade of 'Incomplete' (I) is granted only in the rare circumstances that an emergency prevents a student in good standing from finishing the course in its last few weeks. As per the CAS Bulletin:

> "Students who are ill or have a serious personal problem should see, call, or write to an adviser in the College Advising Center, College of Arts and Science, New York University, Silver Center, 100 Washington Square East, Room 905, New York, NY 10003-6688; 212-998-8130."

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[1]courtesy C. Jankowski

NYU Classes: The chief means of communication for this course will be the course Classes site, accessed through `newclasses.nyu.edu`. Students are expected to check this for up-to-date assignments—including material separate from the text—and announcements.

Homework: Weekly problem sets with a mix of exercises from the text and supplementary problems will be collected. These include more in-depth problems requiring greater abstraction, understanding and/or synthesis of various concepts. In many ways, these constitute the heart of the course; rigor in their completion often yields the greatest understanding.

Quizzes: Weekly quizzes will be given on (most) Wednesdays. These will generally cover material on the previous week's homework.

When calculating the homework and quiz grades for the semester, the lowest score in each of these areas will be dropped. **N.B.** It is advised that students reserve these "passes" for unexpected absences. In fairness to all students and graders, **late homework will not be accepted.**

Exams: There will be two in-class exams during the semester. See the attached schedule for likely dates.

Final Exam: The final exams for both section will take place on Wednesday, May 13. See the registrar's site for specific times.

Policy on out-of-sequence exams and missed quizzes

We are only able to accommodate a limited number of out-of-sequence exams due to limited availability of rooms and proctors. For this reason, we may approve out-of-sequence exams in the following cases:

- A documented medical excuse.
- A University sponsored event such as an athletic tournament, a play, or a musical performance. Athletic practices and rehearsals do not fall into this category. Please have your coach, conductor, or other faculty advisor contact your instructor.
- A religious holiday.
- Extreme hardship such as a family emergency.

We will **not** be able to accommodate out-of-sequence exams, quizzes, and finals for purposes of more convenient travel, including already purchased tickets. Please note again the date of the final and plan your summer travel accordingly.

Scheduled out-of-sequence exams and quizzes (those not arising from emergencies) must be taken before the actual exam. Makeups must occur within one week of the regularly scheduled exam or quiz, otherwise a zero score will be given.

If you require additional accommodations as determined by the Center for Student Disabilities, please let your instructor know as soon as possible.

Technology: Technology can play an important role in the learning of mathematics, and as such, graphing and scientific calculators are permitted for class and homework, though they will not be required. Calculators will not be permitted on tests and quizzes, and thus it is emphasized that students learn not to rely on them.

Academic Honesty: Guidelines regarding cheating and plagiarism are laid out in the College of Arts and Sciences guidelines and will be adhered to strictly. Collaboration is permitted, in fact encouraged, for home and class assignments; however, all submitted assignments must be written up independently and represent the student's own work and understanding.

Below is a proposed schedule for covering topics and assignments during the semester. All are subject to change as the semester progresses.

Day	MW	Sections	Topic	Due	Note
1	1/26/2015	§1.1, §1.2	Systems of linear equations; row reduction		
2	1/28/2015	§1.3, §1.4	Vector equations		
3	2/2/2015	§1.5	Solution sets	HW1	
4	2/4/2015	§1.7, §1.8	Linear independence		
5	2/9/2015	§1.9	Matrix of a linear transformation	HW2	
6	2/11/2015	§2.1, §2.2	Matrix operations; inverses		
7	2/18/2015	§2.3	Invertibility	HW3	
8	2/23/2015	§2.4, §2.5	Factorizations		
9	2/25/2015	§3.1	Determinants	HW4	Review for Midterm I
10	3/2/2015		MIDTERM EXAM I (through §3.1)		
11	3/4/2015	§3.2	More determinants		
12	3/9/2015	§4.1, §4.2	Vector spaces		
13	3/11/2015	§4.3	Bases		
14	3/23/2015	§4.4, §4.5	Coordinate systems; dimension	HW5	
15	3/25/2015	§4.6	Rank		
16	3/30/2015	§4.7	Change of basis	HW6	
17	4/1/2015	§5.1, §5.2	Eigendinge		
18	4/6/2015	§5.3, §5.4	Diagonalization	HW7	
19	4/8/2015	§5.5	Complex eigenvalues		
20	4/13/2015	flex	Review for Midterm II	HW8	
21	4/15/2015		MIDTERM EXAM II (through §5.3)		
22	4/20/2015	§6.1	Inner product		
23	4/22/2015	§6.3, §6.4	Orthogonal projections	HW9	
24	4/27/2015	§6.5	Least-squares problems		
25	4/29/2015	§7.1	Symmetric matrices	HW10	
26	5/4/2015	§7.4	Singular value decomposition		
27	5/6/2015	flex		HW11	
28	5/11/2015	flex	Review		
	5/13/2015		Final Exam: Sect 002: 5/13 12:00pm–1:50pm Sect 005: 5/13 4:00pm–5:50pm		