Syllabus for Math 4406/5506, Advanced Linear Algebra, Section 1
Spring 2012

Instructor. Raz (Dennis) Stowe

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Office hours. MW 10:00–12:00 and TuTh 10:45–12:00 in PS 321A

Textbook. Serge Lang, *Linear Algebra*, 3rd edition, Springer, 1987.

Prerequisite. Math 2240, Linear Algebra.

Objectives. The introduction to linear algebra that Math 2240 provides is limited, simply because that is a three-credit course that assumes no prior knowledge of the subject. Math 4406/5506 expands the treatment in several ways, notably:

1. We consider vector spaces over "fields" other than the real numbers, the most important instances being complex vector spaces.
2. We view linear transformations as fundamental and the matrices that represent them as secondary. Matrices remain important for computation, however, and we certainly will use them.
3. We determine the general structure of linear transformations from a vector space to itself, even when the transformations are not "diagonalizable." In particular, we develop what is called Jordan normal, or canonical, form.
4. We study scalar products on a vector space, orthogonality, and the concepts of symmetry and adjoint or transpose that arise when studying linear transformations between spaces with scalar products.

You will come out of the course knowing what every mathematician should know about linear algebra. That understanding will help you in courses such as numerical analysis, multivariate statistics, and multivariable calculus, as well as courses in mathematics and physics that use vector spaces of functions.

This course is much theoretical than technical. You will not be able to compute eigenvalues more efficiently than before but will gain independence and confidence in your ability to handle new mathematics: You will know what is correct or incorrect, and why. Proofs are an important ingredient. You will improve your ability to write complete, sensible, and efficient arguments and to construct counterexamples to incorrect assertions.

Grading. Based on homework, regular exams, and a final exam, as follows:

Seven homework assignments at 20 points	140
Three regular exams at 30 points	90
Final exam	45
Total possible	275

Homework. I will assign homework every two weeks and post the assignments on my web page; see the day-by-day schedule on this syllabus for due dates. I encourage you to work on problems with others, but write up solutions on your own. I will not accept late homework unless you are sick. If you do not complete an assignment on time, just hand in what you have completed.

Regular exams. There will be three regular exams, as shown on the day-by-day schedule, each covering the material introduced since the previous exam. You may use an $8\frac{1}{2} \times 11$ sheet of notes (both sides). If you have a good reason for missing an exam *and discuss it with me in advance*, we can arrange a makup.

Final exam. 7:30–9:30 a.m. Thursday, May 3. Comprehensive. As with regular exams, you may use an $8\frac{1}{2} \times 11$ sheet of notes (both sides). I will give the final exam only at the scheduled time.

Disabilities. Our program is committed to students achieving their potential. If you have a disability or think that you have one (physical, learning, hearing, vision, psychiatric) that might need reasonable accommodation, please contact the ADA & Disabilities Resource Center in Room 123 Graveley Hall (282-3599) as soon as possible.

Graduate credit. Students taking this course as Math 5506 will present Sections VII.2 and VIII.5 to the class April 19 and April 24.

Day-by-Day Schedule

Read the indicated sections of the textbook before coming to class. Days that homework is due are marked "(HW)."

1/10	I.1	1/12	I.2
1/17	I.3	1/19	(HW) I.4
1/24	II.1, II.2	1/26	II.3
1/31	III.1, III.2	2/2	(HW) III.3
2/7	III.4	2/9	IV.1, IV.2
2/14	IV.3	2/16	(HW) Exam
2/21	V.1	2/23	V.2
2/28	V.2, VII.1	3/1	(HW) VIII.1
3/6	VIII.2	3/8	VIII.3
3/13	VIII.4	3/15	(HW) Exam
3/20	IX.1, IX.2	3/22	IX.2, minimal polynomial
———	Spring Break		———
4/3	X.1	4/5	(HW) X.2
4/10	Theorem XI.4.2	4/12	XI.6
4/17	Exam	4/19	(HW) VII.2
4/24	VIII.5	4/26	Review

Final exam 7:30–9:30 a.m. Thursday, May 3.