December 1, 2016

Course Info for Math 2210: Applied Linear Algebra

1. **Official Course Description**: Systems of equations, matrices, determinants, linear transformations on vector spaces, characteristic values and vectors, from a computational point of view. The course is an introduction to the techniques of linear algebra with elementary applications. (See the official catalogue for the latest version, at http://catalog.uconn.edu/math/)

2. **Prerequisites**: MATH 1132Q, 1152Q or 2142Q. Recommended preparation: A grade of C- or better in MATH 1132Q. Not open for credit to students who have passed MATH 2144Q or 3210. (See the official catalogue for the latest version, at the link above.)

3. **Credits and contact time**: Three credits. It usually meets for 50×3 or 75×2 minutes with the instructor.

4. **Discussion sections**: None, the instructor should work out examples during lectures.

5. **Is this course coordinated?** Yes, but only in a light way (book and syllabus are fixed by committee).

6. **Is there a minimal syllabus?** Yes. See the end of this document.

7. **Homework, Quizzes, Clickers.** Instructors usually give weekly or biweekly homework and in-class short quizzes.

8. **Textbook**: The book for this course is decided by the Undergraduate Program Committee and it **must not be changed**. Picking your own book creates problems if a student switches sections. You can get a copy of the book from the Undegraduate Program Assistant in the main office. The book is "Linear Algebra And Its Applications" by David C. Lay.

9. **Faculty contacts**: David Gross, Álvaro Lozano-Robledo, Tom Roby.

10. **Comments**: Our department has an abstract linear algebra course (Math 3210), but that is taken mostly by pure math majors, so Math 2210 is often the ONLY linear algebra course a lot of our majors take. They should therefore be exposed to general vector spaces (both finite and infinite-dimensional), not just vector spaces of n-tuples. See the minimal syllabus for more.

11. **Information from past semesters**: Go to http://www.math.uconn.edu/courses/current-courses/ and scroll down the "Section" column to find links to past course webpages. The semester and campus can be changed at the top of the page.

12. **Past exams**: See the main office (underg. prog. asst.) for files of past syllabi and exams from this course. You may also ask the faculty contacts listed above for examples.

Minimal Syllabus for Math 2210: Applied Linear Algebra

The following is a MINIMAL syllabus and is not intended to be a syllabus for the entire course. Rather, it is intended to provide a minimal list of topics, techniques and concepts which instructors for later courses can assume students have learned in this course. **The following is a minimal list of topics to be covered**:

Systems of linear equations	Linearly independent sets
Row reduction and echelon forms	Bases and Coordinate Systems
Solution sets of linear systems	Dimension of a vector space
Linear independence	Rank
Linear Transformations	Change of Basis
The matrix of a linear transformation	Eigenvectors and eigenvalues (of linear transformations)
Matrix operations	Characteristic polynomial
Inverses and invertible matrices	Diagonalization
Determinants	Inner product, length, orthogonality
Vector spaces, subspaces	Gram–Schmidt process
Null spaces, column spaces	

The topics above are taken from the book *Linear Algebra and its Applications*, 3rd ed., by David C. Lay, sections 1.1-1.5, 1.7-1.9, 2.1-2.3, 2.5, 3.1-3.3, 4.1-4.4, 5.1-5.4, 6.1-6.4. Some additional topics could be chosen from:

Least Squares	Markov Chains
Difference Equations	Google's search algorithm
Diagonalizing real symmetric matrices	Quadratic forms
Complex Eigenvalues	Singular Value Decomposition

Besides vector spaces of n-tuples, examples of other vector spaces appropriate to the level of this course are

1. Hyperplanes through the origin in $\mathbf{R}^n$ (other than the standard coordinate hyperplanes), which have no preferred coordinate system.
2. The space $C([0,1])$ of continuous functions $[0,1] \to \mathbf{R}$.
3. The space of one-variable polynomials, or of one-variable polynomials of degree *at most* n; for both specific small n and for general n.

This course is a bridge to more advanced courses where taking an abstract view of things becomes more important (particularly, but not only Math 2710 Transition to Advanced Mathematics). As such, students should begin learning how to distinguish true statements from false ones, and to give simple explanations and counterexamples. It is important for instructors to try to support students as they begin making the transition away from much more computationally-focussed courses (1131-32, 2110, 2410).