Math 240-01, Linear Algebra, Spring 2013

MWF 8:15-9:20 am, OSS 214

Instructor: Amy DeCelles

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Office hours: MWF 9:30-11:30, and by appointment

Course Prerequisites: A grade of C- or above in MATH 200; may be taken concurrently

Credits and Workload Expectations: 4 credits: 8-10 hours per week outside the classroom.

Course Materials and Resourses:

- Textbook: *Linear Algebra and its Applications*, 4th edition, by David C. Lay
- *Mathematica* Software: https://www.stthomas.edu/irt/desktopsupport/software/

Overview: We will be studying the mathematics of phenomena that depend linearly on several parameters. Such phenomena can be modeled by **systems of linear equations**. We will discuss algorithms for computing solutions to systems of linear equations using **matrices**, rectangular arrays of numbers. Matrices can also be viewed geometrically as **linear transformations** on n-dimensional space. This viewpoint provides a segue to the notion of a linear transformation of an **abstract vector space**. We use **eigenvectors and eigenvalues** to describe the action of matrices and linear transformations in terms of simpler scaling actions. Finally we discuss a generalization of the dot product, the **inner product**, which encodes all the geometric information (length, distance, orthogonality) about a vector space, and, in particular, provides a notion of approximation in vector spaces.

Course Objectives:

- Gaining factual knowledge (terminology and methods of linear algebra)
- Learning fundamental principles, generalizations, and theories (noticing patterns, working with abstract mathematical objects)
- Learning to apply course material (apply methods of linear algebra to real world problems and interpret the results)
- Developing skill in expressing myself orally or in writing (clear written explanations of mathematical processes and results, formal mathematical arguments)

Homework: Weekly homework consists of practice problems and written exercises from the book, and occasionally a short (1-3 paragraph) essay, typically due in class on Monday and returned within the week. The practice problems will be graded for completion, and the written exercises and essays will be graded on a qualitative scale.

Projects: Over the course of the semester you will complete two modeling projects in groups using *Mathematica*. Each project will require a written report.

Final Course Grade: The final grade for this course will be computed as follows:

- Practice Problems (10%): practice problems (book), graded for completion
- Written Assignments (40%): written exercises (book), essays, projects
- Practice Quizzes (10%): tentatively scheduled for Feb 15, Apr 5, and May 1
- Midterm Exams (20%): tentatively scheduled for Mar 5 and Apr 17
- Final Exam (20%): cumulative; 8:00 am - 10:00 am Tues May 21

Make-up midterm exams may be given to students with legitimate excuses such as verified illness, University sponsored events, etc., as long as the make-up exam can be taken within a reasonable time frame. If it is not possible to schedule a make-up exam within a reasonable time frame, the grade for the midterm may be prorated from the final exam. Written documentation is required.

Disability Accommodations: Qualified students with documented disabilities who may need classroom accommodations should make an appointment with the Disability Resources office. Appointments can be made by calling 651-962-6315.You may also make an appointment in person in Murray Herrick, room 110. For further information, you can locate the Disability Resources office on the web at http://www.stthomas.edu/enhancementprog/.

Tentative Course Schedule for Math 240-01, Linear Algebra, Spring 2013

Mon	Wed	Fri
Feb 4, 2013	Feb 6, 2013	Feb 8, 2013
Introduction; 1.1 Systems of Linear Equations	1.2 Row Reduction 1.3 Vector Equations	1.4 Matrix Equation Viewpoint
Feb 11, 2013	Feb 13, 2013	Feb 15, 2013
1.5 Solution Sets of Linear Systems (Discuss Quiz 1)	1.7 Linear Independence	**Quiz 1** (1.1-1.7) (Assign MM1) (Last day to drop)
Feb 18, 2013	Feb 20, 2013	Feb 22, 2013
1.8 Linear Transformations	Activity: Linear Transformations of the Plane	1.9 The Matrix of a Linear Transformation
Feb 25, 2013	Feb 27, 2013	Mar 1, 2013
2.1 Matrix Operations	2.2 Inverse of a Matrix	2.3 Invertible Matrices
Mar 4, 2013	Mar 6, 2013	Mar 8, 2013
Open	**Exam 1** (1.1-2.3)	2.5 Matrix Factorizations (MM1 due)
Mar 11, 2013	Mar 13, 2013	Mar 15, 2013
3.1 Intro to Determinants	3.2 Properties of Determinants (Last day for S/D/R)	Start 4.1, Vector Spaces
Mar 18, 2013	Mar 20, 2013	Mar 22, 2013
Continue 4.1, Subspaces	4.2 Null Spaces, Column Spaces, and Linear Transformations	4.3 Linearly Independent Sets and Bases
Mar 25, 2013	Mar 27, 2013	Mar 29, 2013
Spring	Break	Good Friday
Apr 1, 2013	Apr 3, 2013	Apr 5, 2013
Easter Monday	4.4 Coordinate Systems	**Quiz 2** (2.5-4.3)
Apr 8, 2013	Apr 10, 2013	Apr 12, 2013
4.5 Dimension of a Vector Space	4.5 (con't)	4.6 Rank (Assign MM2)
Apr 15, 2013	Apr 17, 2013	Apr 19, 2013
Open (Instructor gone)	**Exam 2** (2.5-4.6) (Instructor gone)	5.1 Eigenvectors and Eigenvalues (Instructor gone)
Apr 22, 2013	Apr 24, 2013	Apr 26, 2013
5.2 The Characteristic Equation	5.3 Diagonalization (Last day to withdraw)	Activity: Dot Product in the Plane, Intro to Inner Product (Instructor gone)
Apr 29, 2013	May 1, 2013	May 3, 2013
6.1 and 6.2 Inner Product and Orthogonality	**Quiz 3** (5.1-6.2A)	Activity: Inner Product on a Function Space
May 6, 2013	May 8, 2013	May 10, 2013
6.3 Orthogonal Projections	6.5 Least Squares Problem (MM2 due)	Activity: Approximations in a Function Space
May 13, 2013	May 15, 2013	May 17, 2013
7.1 Diagonalization of Symmetric Matrices	7.2 Quadratic Forms (Last day for incompletes)	Open (Last day of class)

Final Exam 8:00 am -10:00 pm Tues. May 21