UNIVERSITY OF SOUTHERN CALIFORNIA
MING HSIEH DEPARTMENT OF ELECTRICAL ENGINEERING

EE 241 Applied Linear Algebra for Engineering

Basic Information

Instructor: Prof. Todd Brun Phone: (213) 740-3503
Office: EEB 502 Email: tbrun@usc.edu
Office hours: Mon 2-4 pm, Thu 1-3 pm

Lecture: Tue Thu 3:30-4:50, KAP 140

Discussion: Wed 3:30-4:20, KAP 158

Text: Introductory Linear Algebra
by: B. Kolman and D.R. Hill, 8th Ed.

Additional References: Introduction to Scientific Computing (on MATLAB), C. F. Van Loan
Linear Algebra for Engineers and Scientists Using MATLAB, K. Hardy

Webpage: https://blackboard.usc.edu/ (log in and follow the links to EE 241)

Prerequisites: Math 126, EE 100 or equivalent

Classroom Policy

Electronic communication devices (phones, blackberries, and similar) must be turned off or placed away during lectures. Likewise, you should not use instant messenger or similar chat programs during lectures.

Course Goals and Learning Objectives

Goals: Introduction to the theory of matrices, vector spaces, least-squares approximation and MATLAB. Applications to communications, control and signal processing.

Learning Objectives: After successfully completing this course, you should be able to:

- find all solutions (if any) to a set of linear equations, both by hand and using MATLAB;
- completely understand matrix manipulations;
- find the determinant and inverse of a matrix;
- take inner products between vectors;
- know the definition of a vector space;
- know the definition of a linear map;
- find a basis for a vector space or subspace;
- find an orthonormal basis for a vector space or subspace;
- find the projector and orthogonal complement of a subspace;
- find a matrix representation of a linear map;
- identify the range, nullspace, rank, and nullity of a linear map;
- solve for the eigenvalues and eigenvectors of a matrix, and diagonalize matrices;
- approximate solutions using least squares.

You should be able to apply linear algebra to:

- problems in probability;
- fitting polynomials to data;
- analyzing graphs and networks;
- performing geometric transformations in two and three dimensions;
- doing compression and error correction of data;
- extracting signals from noisy data;
- solving linear ordinary differential equations.

Course Plan and Weekly Reading

Week	Subject	Text pages & Homeworks
1	Linear Equations and Matrices Linear systems, method of elimination Matrices: addition, transpose, and product.	Chapter 1 1-29
2	Matrix form of a linear system of equations. Solving a linear system of equations. Reduced row echelon form, Gauss-Jordan method Homogeneous systems.	39-78 HW 1 due
3	Application examples. Polynomial Interpolation example. Inverse of a matrix & related theorems and applications. Determinants. Permutations.	91-102 Chapter 3 182-185 HW 2 due
4	Properties of determinant. Geometric significance of determinant. Expansion in cofactors. Inverse of a matrix. Examples.	186-207 HW 3 due
5	Determinants from a computational point of view. Vectors in R^2 and R^n. Norm (Length or Magnitude). Using determinant to compute area. Angle between Vectors. Vector addition and scalar multiplication.	210-211 Chapter 4 214-226 HW 4 due
6	Schwartz inequality. Triangle inequality. Linear transformations. Cross product in R^3.	229-254 Chapter 5 259-263
7	**Midterm Exam 1** Lines and Planes in R^3.	264-269
8	Real vector spaces. Examples. Subspaces. Nullspace. Nullity.	Chapter 6 272-287 HW 5 due
9	Linear combinations. Spanning. Linear independence. Basis. Dimension.	291-314 HW 6 due

Week	Subject	Text pages & Homeworks
	Spring Break 12-17 March 2012	
10	Homogeneous systems. Row space. Column space. Rank. Coordinates and change of Basis.	317-342 HW 7 due
11	Transition matrix. Orthonormal Bases Gram-Schmidt Orthogonalization.	343-358
12	**Midterm Exam 2** Intersection, union, and sum of subspaces	
13	Orthogonal complements. Examples. Projections.	360-369 HW 8 due
14	Eigenvalues and Eigenvectors. Characteristic equation. Similar matrices. The diagonal form of a matrix. Application to symmetric matrices.	Chapter 8 408-441 HW 9 due
15	Least squares. Approximate solutions. Fitting.	Chapter 7 378-387 HW 10 due

COURSE GRADE:	Homeworks	20%
	Midterm Exam 1	20%
	Midterm Exam 2	20%
	Final Exam	40%

Homeworks: Assigned weekly, due one week after assigned. Some computer homeworks will be announced to be due in two weeks after assigned

Midterm Exams: These will be given during regular class sessions in the weeks indicated in the schedule above, and will be a mix of multiple choice questions, short exercises, and longer multi-part problems. The exams will be closed-book, but prepared note sheets may be brought. Nonscientific calculators may also be used (i.e., no calculators with matrix functions).

FINAL EXAM DATE: Tuesday 8 May 2012, 2:00-4:00 p.m.

Policy Against Cheating

All USC students are responsible for reading and following the Student Conduct Code, which appears in the Scampus and at http://www.usc.edu/dept/publications/SCAMPUS/goverance.

The USC Student Conduct Code prohibits plagiarism. Some examples of what is not allowed by the conduct code: copying all or part of someone else's work (by hand or by looking at others' files, either secretly or if shown), and submitting it as your own; giving another student in the class a copy of your assignment solution; consulting with another student during an exam; modifying a graded assignment before asking for re-grading. It is permissible for students

to study together, but all work must be done individually. If you have questions about what is allowed, please discuss it with the instructor.

The policy regarding incidental cheating for this course is the following: students found cheating on a homework assignment will receive a grade of zero on that assignment. Repeat offenders will expose themselves to the general University policy. Students who violate University standards of academic integrity are subject to disciplinary sanctions, including failure in the course and suspension from the University. Since dishonesty in any form harms the individual, other students, and the University, policies on academic integrity will be strictly enforced. We expect you to familiarize yourself with the Academic Integrity guidelines found in the current Scampus. Violations of the Student Conduct Code will be filed with the Office of Student Conduct, and appropriate sanctions will be given.

This policy does not forbid discussion or exchange of information between students. On the contrary, we encourage you to consult with classmates about the lecture material and homework assignments. However, it is required that you prepare the final product by yourself and to the best of your ability. Copying is expressly banned.

Disability Policy Statement

Any Student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to the TA) as early in the semester as possible.