Math 33A: General Course Outline

Catalog Description

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33A. Linear Algebra and Applications. (4) Lecture, three hours; discussion, one hour. Requisite: course 32A with a grade of C- or better. Introduction to linear algebra: systems of linear equations, matrix algebra, linear independence, subspaces, bases and dimension, orthogonality, least-squares methods, determinants, eigenvalues and eigenvectors, matrix diagonalization, and symmetric matrices. P/NP or letter grading.

Textbook

O. Bretscher, Linear Algebra, 4th Ed., Prentice Hall.

Reviews & Exams

The following schedule, with textbook sections and topics, is based on 26 lectures. The remaining classroom meetings are for leeway, reviews, and two midterm exams. These are scheduled by the individual instructor.

Schedule of Lectures

| Lecture | Sections | Topics |
|---------|-------------------|--|
| 1-2 | Chapter 1 (1.1-3) | Linear systems, Gauss-Jordan elimination |
| 3-6 | Chapter 2 (2.1-4) | Linear transformations, inverses, matrix algebra |
| 7-10 | Chapter 3 (3.1-4) | Subspaces of R ⁿ , linear independence, bases, dimension, kernel and image of linear transformations, coordinates |
| 11-15 | Chapter 5 (5.1-4) | Orthogonality, orthonormal bases, orthogonal projections, orthogonal transformations, orthogonal matrices, Gram-Schmidt process, QR-factorization, least squares methods |
| 16-19 | Chapter 6 (6.1-3) | Determinants |
| 20-23 | Chapter 7 (7.1-5) | Eigenvalues, eigenvectors, diagonalization of matrices |
| 24-26 | Chapter 8 (8.1-3) | Symmetric matrices, SVD (singular-value decomposition) |

Comments

Since the syllabus includes some important material for engineers at the end of the course (Chapter 8), the pacing of lectures is particularly important. Some time can be saved by synopsising the properties of determinants and leaving the details to the students. The students are already familiar with two-by-two and three-by-three determinants.

Most of the students are already familiar with matrix multiplication.

The ad hoc definition of "linear transformation" in Section 2.1 should be replaced by the correct definition, which can then be related to the definition given in the textbook.

Chapter 4 (Abstract Vector Spaces) and Section 5.5 (Inner Product Spaces) are omitted. Abstract vector spaces are treated in Math 115A.

The QR decomposition in Section 5.2 is important for the engineers.

Most students will have seen the polar form of complex numbers given in Section 7.5 (in high school), but most students will not have seen the exponential form (Euler's formula) in previous courses.

Positive-definite matrices (Section 8.2) and the singular-value decomposition (Section 8.3) are very important for the engineers.

Outline update: T. Gamelin, 3/04

For more information, please contact Student Services, ugrad@math.ucla.edu.