

Math 342, Elementary Linear Algebra

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Text: Linear Algebra, David C.Lay.

Prerequisites: Math 341.

Tentative course outline :

1. Vector spaces: short review of 4.1- 4.6;
2. Change of basis: 4.7;
3. Eigenvectors and eigenvalues, the characteristic equation: 5.1, 5.2;
4. Diagonalization of linear transformations: 5.3;
5. Eigenvalues of linear transformations, complex eigenvalues: 5.4, 5.5.
6. Inner product and orthogonality: 6.1, 6.2;
7. Orthogonal projections, the Gram- Schmidt process: 6.3-6.4;
8. Notion of inner product spaces: 6.8;
9. Symmetric matrices: 7.1 (if time allows).

Exams: Usually 3 exams are given: the first midterm on week 5, the second midterm on week 9 and the final exam.

In order to pass the course the students should be able to perform most of the following tasks.

1. Find the change of coordinate matrices.
2. Calculate eigenspaces for given eigenvalues.
3. Find the eigenvalues of a matrix if it is possible.
4. Diagonalize a matrix if it is possible.
5. Calculate the matrix of a linear transformation relative to given bases.
6. Reduce a 2×2 real matrix with complex eigenvalues to the normal form (5.5).
7. Calculate inner products and lengths of vectors.
8. Determine if a set of vectors is orthonormal.
9. Calculate the orthogonal projection of a vector onto the span of vectors.
10. Given a basis, produce an orthogonal basis.

The main idea of the course is that several abstract mathematical notions, such as vector spaces, linear transformations, etc., reduce in one way or another to vectors in \mathbb{R}^n , matrices, and other quite concrete ones.