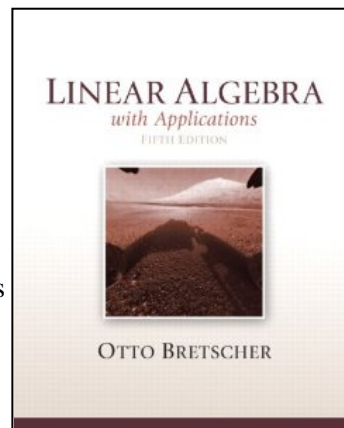Department of Mathematics
Johns Hopkins University

110.201 Linear Algebra
Course Syllabus

The following list of topics is considered the core content for the course 110.201 Linear Algebra. The current text for the course is:

Text: Linear Algebra with Applications, *5th Edition*, Otto Bretscher, Prentice Hall, December 2012, ISBN-13: 978-0321796974.

Course Topics

- **Linear Equations (1 week)**
    - o 1.1 Introduction to Linear Systems
    - o 1.2 Matrices and Gauss-Jordan Elimination
    - o 1.3 On the Solutions of Linear System

- **Linear Transformations (2- weeks)**
    - o 2.1 Introduction to Linear Transformations and Their Inverses
    - o 2.2 Linear Transformations in Geometry
    - o 2.3 The Inverse of a Linear Transformation
    - o 2.4 Matrix Products

- **Subspaces of $\mathbb{R}^n$ and Their Dimensions (2- weeks)**
    - o 3.1 Image and Kernel of a Linear Transformation
    - o 3.2 Subspaces of $\mathbb{R}^n$; Bases and Linear Independence
    - o 3.3 The Dimension of a Subspace of $\mathbb{R}^n$
    - o 3.4 Coordinates

- **Linear Spaces (1 week)**
    - o 4.1 Introduction to Linear Spaces
    - o 4.2 Linear transformations and Isomorphisms
    - o 4.3 Coordinates in a Linear Space

- **Orthogonality and Least Squares (2 weeks)**
    - o 5.1 Orthonormal Bases and Orthogonal Projections
    - o 5.2 Gram-Schmidt Process and *QR* Factorization
    - o 5.3 Orthogonal Transformations and Orthogonal Matrices
    - o 5.4 least Squares and Data Fitting
    - o 5.5 Inner Product Spaces

- **Determinants (1 week)**
    - o 6.1 Introduction to Determinants
    - o 6.2 Properties of the Determinant
    - o 6.3 Geometrical Interpretations of the Determinant: Cramer's Rule

- **Eigenvalues and Eigenvectors (2- weeks)**
  - 7.1 Dynamical Systems and Eigenvalues: An Introductory Example
  - 7.2 Finding the Eigenvalues of a Matrix
  - 7.3 Finding the Eigenvectors of a Matrix
  - 7.4 Diagonalization
  - 7.5 Complex Eigenvalues

- **Symmetric Matrices and Quadratic Forms (1 weeks)**
  - 8.1 Symmetric Matrices
  - 8.2 Quadratic Forms
  - 8.3 Singular Values