

**University of Houston**  
**Department of Mathematics**  
**Syllabus—Math 2331, Linear Algebra**

**Text:** “*Introduction to Linear Algebra*” by Gilbert Strang, Third Edition. Wellesley-Cambridge Press.

**Text Web Site:** <http://web.mit.edu/18.06/www/>

**Online Lectures:** <http://web.mit.edu/18.06/www/Video/video-fall-99-new.html>

**Prerequisite:** Credit for or concurrent enrollment in MATH 1432.

**Course Description:** Solutions of linear systems of equations, vector spaces and subspaces, orthogonality, determinants, linear transformations.

**Course Outline**

**Chapter 1: Introduction to Vectors**

1.1-1.2 Vectors and Linear Combinations, Lengths and Dot Products

**Chapter 2: Solving Linear Equations**

- 2.1 Vectors and Linear Equations
- 2.2 The Idea of Elimination
- 2.3 Elimination Using Matrices.
- 2.4 Rules for Matrix Operations
- 2.5 Inverse Matrices
- 2.6 Elimination = Factorization:  $\mathbf{A} = \mathbf{LU}$
- 2.7 Transposes and Permutations

**Exam**

**Chapter 3: Vector Spaces and Subspaces**

- 3.1 Spaces of vectors
- 3.2 The Nullspace of  $\mathbf{A}$ : Solving  $\mathbf{Ax} = \mathbf{0}$
- 3.3 The Rank and the Row Reduced Form
- 3.4 The Complete Solution to  $\mathbf{Ax} = \mathbf{b}$ .
- 3.5 Independence, Basis and Dimension
- 3.6 Dimensions of the Four Subspaces

**Chapter 4: Orthogonality**

- 4.1 Orthogonality of the Four Subspaces
- 4.2 Projections
- 4.3\* Least Squares Approximations (Optional)

#### 4.4 Orthogonal Bases and Gram-Schmidt

\*Application to least squares at end of 4.4 is optional

### **Exam**

#### **Chapter 5: Determinants**

5.1 The Properties of Determinants

5.2 Permutations and Cofactors

5.3 Cramer's Rule, Inverses, and Volumes

#### **Chapter 6: Eigenvalues and Eigenvectors**

6.1 Introduction to Eigenvalues

6.2 Diagonalizing a Matrix

6.4 Symmetric Matrices

6.5 Positive Definite Matrices

6.6 Similar Matrices

6.7\* Singular Value Decomposition (Optional)

### **Exam**

#### **Chapter 7: Linear Transformations**

7.1 The Idea of a Linear Transformation

7.2 The Matrix of a Linear Transformation

### **Review**

### **Final Exam**