MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS

LINEAR ALGEBRA
MATH 271

PREREQUISITE: Math 161 with a grade of C or better
TEXT: Linear Algebra and its applications, 3rd ed., by David C. Lay
RECOMMENDED SUPPLEMENT: The Student Study Guide
COVERAGE: Chapters 1-5 and parts of 6-7.

COURSE OUTLINE

1. Linear Equations in Linear Algebra.
   1.1. Systems of Linear Equations
   1.2. Row Reduction and Echelon Forms
   1.3. Vector Equations
   1.4. The Matrix Equation $Ax = b$
   1.5. Solution Sets of Linear Systems
   1.6. Applications of Linear Systems
   1.7. Linear Independence
   1.8. Introduction to Linear Transformations
   1.9. The Matrix of a Linear Transformation
   1.10. Linear Models in Business, Science, and Engineering

2. Matrix Algebra
   2.1. Matrix Operations
   2.2. The Inverse of a Matrix
   2.3. Characterizations of Invertible Matrices
   2.4. Partitioned Matrices
   2.5. Matrix Factorizations
   2.6 The Leontief Input-Output Model
   2.7. Applications to Computer Graphics
   2.8. Subspaces of $\mathbb{R}^n$
   2.9. Dimension and Rank

3. Determinants
   3.1. Introduction to Determinants
   3.2. Properties of Determinants
   3.3. Cramer’s Rule, Volume, and Linear Transformations
4. **Vector Spaces**

4.1. Vector Spaces and Subspaces
4.2. Null Spaces, Column Spaces, and Linear Transformations
4.3. Linearly Independent Sets; Bases
4.4. Coordinate Systems
4.5. The Dimension of a Vector Space
4.6. Rank
4.7. Change of Basis
4.8. Applications to Difference Equations
4.9. Applications to Markov Chains

5. **Eigenvalues and Eigenvectors**

5.1. Eigenvectors and Eigenvalues
5.2. The Characteristic Equation
5.3. Diagonalization
5.4. Eigenvectors and Linear Transformations
5.5. Complex Eigenvalues
5.6. Discrete Dynamical Systems
5.7. Applications to Differential Equations
5.8. Iterative Estimates for Eigenvalues

6. **Orthogonality and Least Squares**

6.1. Inner Product, Length, and Orthogonality
6.2. Orthogonal Sets
6.3. Orthogonal Projections
6.4. The Gram-Schmidt Process
6.5. Least-Squares Problems
6.6. Applications to Linear Models

7. **Symmetric Matrices and Quadratic Forms**

7.1. Diagonalization of Symmetric Matrices
7.2. Quadratic Forms