Mathematics Department
Brooklyn College, City University of New York
Math 2101 (Linear Algebra I)
3 hours lecture, 1 hour recitation; 3 credits

Suggested Textbooks:
- Matrices and Linear Algebra, second edition, by Hans Schneider and George Phillip Barker
- Linear Algebra and its applications, fourth edition, by David Lay
- Elementary Linear Algebra: applications version, eleventh edition, by Howard Anton and Chris Rorres

1. Matrix algebra
   - Matrices and matrix operations
   - Algebraic properties of matrices
   - Invertible matrices
   - Matrix inversion algorithm

2. Systems of linear equations
   - Homogeneous and non-homogeneous systems
   - Matrix representations of linear systems
   - Row reduction algorithms for matrices
   - Row echelon form

3. Determinants
   - Properties of determinants
   - Determinants by cofactor expansion
   - Cramer's rule

4. Vector spaces
   - Definition and elementary properties
   - Examples, including matrices, geometric vectors, and function spaces
   - Subspaces

5. Linear independence
   - Sets of linearly independent vectors
   - Span, dimension, and basis
   - Coordinates with respect to different bases
   - Isomorphism between vector spaces of the same dimension

6. Linear transformations
   - Definition and examples
   - Properties. Addition and composition of transformations
   - Inverse transformation
   - Matrix representation of linear transformations
   - Null space and range
   - Matrix representation with change of basis

7. Inner product spaces
   - Dot product, norm and distance
   - Orthogonality and orthogonal projections
   - Orthogonal bases
   - Gram-Schmidt process
   - Eigenvalues and eigenvectors; the characteristic equation
   - Diagonalizable matrices; Symmetric matrices