

DEPARTMENT OF MATHEMATICS
SYLLABUS

Course # & Name: MAT 167: Applied Linear Algebra

Recommended Text(s) & Price: Gilbert Strang: Linear Algebra and Its Applications, 4th Ed., Brooks/Cole, 2006. Price: \$161.95

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PREREQUISITES: 22A (Linear Algebra) or 67 (Modern Linear Algebra)

Lecture(s)	Sections	Comments/Topics
1 st Week	From various sources (see note below)	What is Applied Linear Algebra? Motivational introduction with examples
2 nd Week	Sec. 1.4-1.6	Systems of linear algebraic equations, LU factorization and its applications
3 rd Week	Sec.2.1-2.3, 2.6	Vector spaces, subspaces, bases, linear transformations
4 th Week	Sec. 3.1, 3.2, 3.4	Orthogonality. QR factorization and Gram-Schmidt process I.
5 th Week	Sec. 3.3; Midterm Exam	Orthogonality. QR factorization and Gram-Schmidt process II. Applications to least squares problems
6 th Week	Sec. 5.1-5.3	Eigenvalue decomposition and its applications I
7 th Week	Sec.5.4-5.6	Eigenvalue decomposition and its applications II
8 th Week	Sec. 6.3 with extra material	Singular value decomposition and its applications I
9 th Week	Sec. 6.3 with extra material	Singular value decomposition and its applications II
10 th Week	Some appropriate sections from the text as well as extra material, handouts	Other applications (see notes below)

Additional Notes:

- Basic concepts of linear algebra (22A or 67) are assumed and will not be reviewed in the class. The instructor should explicitly inform the enrolled students of this requirement.
- Knowledge of programming language is required. A certain number of programming projects will be assigned in the course. Applications of least squares, eigenvalue decomposition, singular value decomposition form good programming projects.
- In the 1st Week, it is important to motivate the students using important examples to show how linear algebra is used in real world. Suggested examples are: image compression, web search engines, inverse problems (e.g., tomography), etc.
- In the 8th and 9th Weeks, the instructor should supply some applications of SVD including web search engines, least squares problems, image approximations, inverse problems in a more details manner some of which were discussed in the 1st Week.
- In the 10th Week, an instructor can freely choose various applications of interest. Examples are:
 - Sec. 2.5 Graphs and Networks;
 - Sec. 3.5 The Fast Fourier Transform;
 - Sec. 6.1-6.2 Positive Definite Matrices
 - Sec. 8.2 The Simplex Method and Karmarkar's Method.Other possible sources of material are:
 - Carl D. Meyer: Matrix Analysis and Applied Linear Algebra, SIAM, 2000.
 - Lloyd. N. Trefethen and Davis Bau, III: Numerical Linear Algebra, SIAM, 1997.
 - Michael W. Berry and Murray Browne: Understanding Search Engines: Mathematical Modeling and Text Retrieval, 2nd Ed., SIAM, 2005.