

DEPARTMENT OF MATHEMATICS SYLLABUS

Course # & Name: MAT 67: Modern Linear Algebra

Recommended Text
& Price:

“Linear Algebra as an Introduction to Abstract Mathematics”
by Isaiah Lankham, Bruno Nachtergaele and Anne Schilling
(Freely available at
http://www.math.ucdavis.edu/~anne/mat67_course_notes.pdf or
for a nominal fee at the UCD Bookstore)

Prepared by: Nachtergaele,
Schilling, and
Lankham

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| Lec # | Topics | Comments/Topics |
|-------|--|------------------------|
| 1 | What is linear algebra? | Chapter 1 |
| 2, 3 | Complex numbers | Chapter 2 |
| | Discussion: Calculations with complex numbers; encoding linear systems | Covers L1-3; 12.1 |
| 4 | Fundamental theorem of algebra (proof optional) | Chapter 3 |
| 5 | Vector spaces and subspaces | Chapter 4.1 - 4.3 |
| 6 | Direct sum, linear span | Chapter 4.4 – 5.1 |
| | Discussion: Vector space of matrices and operations on matrices | Covers L5, 6; 12.2 |
| 7 | Linear independence of vectors | Chapter 5.2 |
| 8 | Bases and dimensions of vector spaces | Chapter 5.3 – 5.4 |
| 9 | Linear maps | Chapter 6.1 |
| | Discussion: Linear independence, homogenous linear systems, Gaussian elimination | Covers L7, 8; 12.3.1-2 |
| 10 | Null space and range of linear maps | Chapter 6.2 – 6.4 |
| 11 | Dimension formula for a linear map | Chapter 6.5 |
| 12 | Matrix of a linear map | Chapter 6.6 |
| | Discussion: Linear maps, inhomogeneous systems, LU-factorization | Covers L9-12; 12.3.3-4 |
| 13 | Invertibility | Chapter 6.7 |
| 14 | Midterm | |
| 15 | Eigenvalues and eigenvectors | Chapter 7.1 – 7.3 |
| | Discussion: Linear maps | L12, 13; 12.4 |
| 16 | Existence of eigenvalues | Chapter 7.4 |
| 17 | Upper triangular matrix representation | Chapter 7.5 |
| 18 | Diagonalization (2x2) and applications | Chapter 7.6 |
| | Discussion: Eigenvalues and eigenvectors, special operations on matrices | L15-18; 12.5 |
| 19 | Permutations and the determinant | Chapter 8.1 – 8.5 |
| 20 | Properties of the determinant | Chapter 8.6 – 8.7 |
| 21 | Inner product spaces | Chapter 9.1 – 9.2 |
| | Discussion: Calculation of the determinant, inner product spaces | L19-21 |

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| 22 | Cauchy-Schwarz, triangle inequality, Pythagoras | Chapter 9.3 |
| 23 | Orthonormal bases, Gram-Schmidt procedure | Chapter 9.4 – 9.5 |
| 24 | Orthogonal projections, minimization problems | Chapter 9.6 |
| | Discussion: Gram-Schmidt procedure and orthogonal projections | L22-24 |
| 25 | Change of bases | Chapter 10 |
| 26 | Self-adjoint and normal operators | Chapter 11.1 – 11.2 |
| 27 | Spectral theorem for normal maps (complex) | Chapter 11.3 |
| | Discussion: Change of basis, diagonalization | L25-27 |
| 28 | Diagonalization | Chapter 11.4 |
| 29 | Positive operators, polar and singular value decompositions | Chapter 11.6 – 11.7 |

Additional Notes:

Lecture notes “Linear Algebra as an Introduction to Abstract Mathematics by Isaiah Lankham, Bruno Nachtergaele, and Anne Schilling are available on the class website at:

http://www.math.ucdavis.edu/~anne/mat67_course_notes.pdf