

Syllabus for Math 202

Grading: Typically, entry level graduate mathematics courses have one or two midterm examinations and a final examination, with the final examination counting for twice as much of the grade as a midterm examination (a 66% - 34% split with one midterm examination and a 50% - 25% - 25% split with two). On occasion instructors may make slight modifications to these weightings. The research portion of the course will involve significant amounts of further required readings on topics covered in class and the working of numerous exercises at the level tested on the examinations.

Textbook: Trefethen and Bau, Numerical Linear Algebra

The outline specifies 24 standard 50 minute periods of lectures, leaving the additional class periods for examinations, reviews, and extra time for difficult topics.

Generalities, Singular Value Decompositions and QR factorizations (First 2 ½ weeks).

Lectures 1 – 7 and 10 – 11.

Review of basic facts about matrices, vectors and inner products; vector space norms; the Singular Value Decomposition; projections; the QR factorization; Householder transformations; least squares problems.

Conditioning, stability, and solving systems of linear equations (Next 2 ½ weeks).

Lectures 12 – 16 and 20 – 23.

Conditioning and condition numbers for matrices; limitations on computational precision; accuracy and stability; LU factorizations; pivoting; Cholesky factorizations.

Computation of eigenvalues (Next 3 weeks).

Lectures 24 – 30 and 32 – 34.

Review of eigenvalues, eigenvectors and Jordan form; applications to power matrices; Gerschgorin's Theorem; eigenvalue algorithms; reductions to almost diagonal or almost triangular form; Rayleigh's Principle, Rayleigh quotients and their uses; the QR algorithm; the Jacobi method and other approaches; iterative methods.