

Syllabus for the Ph.D. Preliminary Examination in Linear Algebra

Topics

Vector Spaces: subspaces, linear independence, bases, dimension, isomorphism, linear functionals, dual space, bilinear forms.

Matrices and Linear Transformations: range, kernel, determinants, isomorphisms, change of basis, eigenvalues, eigenvectors, minimax theory of eigenvalues, Gersgorin discs, minimal polynomial, Cayley-Hamilton Theorem, similarity, polar and singular value decomposition, spectral theorem, Jordan canonical forms. Hermitian, symmetric and positive definite matrices. Matrix and vector norms.

Inner Product Spaces: inner products, norms, orthogonality, projections, orthogonal complement, orthonormal basis, Gram-Schmidt orthogonalization, linear functionals, isometries, normal operators, spectral theory.

REFERENCES

1. P.R. Halmos, Finite Dimensional Vector Spaces, Springer, 1993.
2. R. Horn and C. Johnson, Matrix Analysis, Cambridge, 1999.
3. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition, Prentice Hall, 1972.
4. Peter Lax, Linear Algebra, Wiley-Interscience, 1997.