1 Linear Algebra

1.1 Dual spaces

Dual spaces, dual basis, double dual, transpose of a linear transformation and
its matrix in the dual basis, annihilators. Eigen spaces of a linear operator, the
minimal polynomial for a linear operator, diagonalizability, invariant subspaces
and Cayley-Hamilton theorem.

1.2 Inner product spaces

Inner product spaces and norms, Gram-Schmidt orthogonalisation process, or-
thogonal complements, best approximation, Bessel's inequality, the adjoint of a
linear operator. Normal, unitary, self-adjoint and positive operators. Orthogo-
nal projections and Spectral theorem.

1.3 The determinant and generalised inverses

Characterisation of determinant as multi-linear function, Generalized inverses
of rectangular matrices, Moore-Penrose (MP) inverse, Singular value decompo-
sition (SVD) of a matrix. reduced SVD, nearest low rank matrix, applications
of SVD.