Part I – Functional spaces

Lebesgue spaces
Continuity of translations
Layer-cake representation
Duality
Convolution, regularization, approximation of the identity
Compactness results
Lebesgue points
Hilbert spaces
Projections

Part II - Fourier transform and applications

Fourier transform in L^1, Schwartz space, L^2, L^p
Analyticity and compact support
Gaussian decays
Laplace transform
Mellin transform
Applications

Suggested readings:

- Haim Brezis, Functional analysis, *Sobolev spaces and partial differential equations*, 2011.
- Serena Dipierro and Enrico Valdinoci, *A primer on the Fourier transform*, 2026.
- Richard L. Wheeden and Antoni Zygmund, *Measure and integral. An introduction to real analysis*, 2015.