

Contents

1	Introduction	1
	Exercises	7
2	Classical Banach Spaces and Their Duals	11
	2.1 Sequence Spaces	11
	2.2 Function Spaces	16
	2.3 Completeness in Function Spaces	24
	Exercises	26
3	The Hahn–Banach Theorems	31
	3.1 The Axiom of Choice	31
	3.2 Sublinear Functionals and the Extension Theorem	32
	3.3 Banach Limits	39
	3.4 Haar Measure for Compact Abelian Groups	44
	3.5 Duals, Biduals, and More	48
	3.6 The Adjoint of an Operator	50
	3.7 New Banach Spaces From Old	53
	3.8 Duals of Quotients and Subspaces	57
	Exercises	58
4	Consequences of Completeness	61
	4.1 The Baire Category Theorem	61
	4.2 Applications of Category	64
	4.3 The Open Mapping and Closed Graph Theorems	71
	4.4 Applications of the Open Mapping Theorem	77
	Exercises	81
5	Consequences of Convexity	83
	5.1 General Topology	83
	5.2 Topological Vector Spaces	86
	5.3 Some Metrizable Examples	88
	5.4 The Geometric Hahn–Banach Theorem	93

- 5.5 Goldstine’s Theorem 106
- 5.6 Mazur’s Theorem 108
- 5.7 Extreme Points 111
- 5.8 Milman’s Theorem 116
- 5.9 Haar Measure on Compact Groups 118
- 5.10 The Banach–Stone Theorem 121
- Exercises 124

- 6 Compact Operators and Fredholm Theory 129**
 - 6.1 Compact Operators 129
 - 6.2 A Rank-Nullity Theorem for Compact Operators 141
 - Exercises 148

- 7 Hilbert Space Theory 151**
 - 7.1 Basics of Hilbert Spaces 151
 - 7.2 Operators on Hilbert Space 157
 - 7.3 Hilbert–Schmidt Operators 166
 - 7.4 Sturm–Liouville Systems 170
 - Exercises 177

- 8 Banach Algebras 181**
 - 8.1 The Spectral Radius 181
 - 8.2 Commutative Algebras 196
 - 8.3 The Wiener Algebra 202
 - Exercises 205

- Appendix A Basics of Measure Theory 207**

- Appendix B Results From Other Areas of Mathematics 219**

- References 225**

- Index 227**



<http://www.springer.com/978-1-4939-1944-4>

An Introductory Course in Functional Analysis

Bowers, A.; Kalton, N.J.

2014, XVI, 232 p. 2 illus., Softcover

ISBN: 978-1-4939-1944-4