

# Contents

<b>1</b>	<b>Introduction</b> .....	1
	Exercises .....	7
<b>2</b>	<b>Classical Banach Spaces and Their Duals</b> .....	11
2.1	Sequence Spaces .....	11
2.2	Function Spaces .....	16
2.3	Completeness in Function Spaces .....	24
	Exercises .....	26
<b>3</b>	<b>The Hahn–Banach Theorems</b> .....	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
<b>4</b>	<b>Consequences of Completeness</b> .....	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
<b>5</b>	<b>Consequences of Convexity</b> .....	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
<b>6</b>	<b>Compact Operators and Fredholm Theory . . . . .</b>	<b>129</b>
6.1	Compact Operators . . . . .	129
6.2	A Rank-Nullity Theorem for Compact Operators . . . . .	141
	Exercises . . . . .	148
<b>7</b>	<b>Hilbert Space Theory . . . . .</b>	<b>151</b>
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
<b>8</b>	<b>Banach Algebras . . . . .</b>	<b>181</b>
8.1	The Spectral Radius . . . . .	181
8.2	Commutative Algebras . . . . .	196
8.3	The Wiener Algebra . . . . .	202
	Exercises . . . . .	205
	<b>Appendix A Basics of Measure Theory . . . . .</b>	<b>207</b>
	<b>Appendix B Results From Other Areas of Mathematics . . . . .</b>	<b>219</b>
	<b>References . . . . .</b>	<b>225</b>
	<b>Index . . . . .</b>	<b>227</b>

An Introductory Course in Functional Analysis

Bowers, A.; Kalton, N.J.

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

ISBN: 978-1-4939-1944-4