Contents

Chapter I
Concepts from Set Theory and Topology
§1. Relations. The Axiom of Choice and Zorn's Lemma
Theory (3). Problems (139). Hints (233).
§2. Completions
Theory (6). Problems (142). Hints (237).
§3. Categories and Functors
Theory (8). Problems (145). Hints (240).

Chapter II
Theory of Measures and Integrals
§1. Measure Theory
1. Algebras of Sets
Theory (12). Problems (150). Hints (244).
2. Extension of a Measure
Theory (13). Problems (152). Hints (246).
3. Constructions of Measures
Theory (18). Problems (154). Hints (250).
§2. Measurable Functions
1. Properties of Measurable Functions
Theory (22). Problems (156). Hints (253).
2. Convergence of Measurable Functions
Theory (23). Problems (158). Hints (255).

§3. Integrals
1. The Lebesgue Integral
Theory (24). Problems (160). Hints (257).
2. Functions of Bounded Variation and the Lebesque–Stieltjes Integral
Theory (28). Problems (163). Hints (263).
3. Properties of the Lebesgue Integral
Theory (31). Problems (166). Hints (266).

Chapter III
Linear Topological Spaces and Linear Operators
§1. General Theory
1. Topology, Convexity, and Seminorms
Theory (38). Problems (170). Hints (271).
2. Dual Spaces
Theory (42). Problems (172). Hints (274).
3. The Hahn–Banach Theorem
Theory (43). Problems (174). Hints (276).
4. Banach Spaces
Theory (46). Problems (176). Hints (279).
§2. Linear Operators
1. The Space of Linear Operators
Theory (50). Problems (178). Hints (282).
2. Compact Sets and Compact Operators
Theory (54). Problems (180). Hints (284).
3. The Theory of Fredholm Operators
Theory (59). Problems (181). Hints (286).
§3. Function Spaces and Generalized Functions
1. Spaces of Integrable Functions
Theory (66). Problems (185). Hints (288).
2. Spaces of Continuous Functions
Theory (68). Problems (187). Hints (291).
3. Spaces of Smooth Functions
Theory (69). Problems (189). Hints (296).
4. Generalized Functions
Theory (78). Problems (192). Hints (298).
5. Operations on Generalized Functions
Theory (81). Problems (195). Hints (300).
§4. Hilbert Spaces
1. The Geometry of Hilbert Spaces
Theory (84). Problems (197). Hints (303).
2. Operators on a Hilbert Space
Theory (90). Problems (200). Hints (305).

Chapter IV
The Fourier Transformation and Elements of Harmonic Analysis

§1. Convolutions on an Abelian Group
1. Convolutions of Test Functions
Theory (95). Problems (204). Hints (309).
2. Convolutions of Generalized Functions
Theory (99). Problems (206). Hints (311).

§2. The Fourier Transformation
1. Characters on an Abelian Group
Theory (104). Problems (209). Hints (313).
2. Fourier Series
Theory (108). Problems (211). Hints (315).
3. The Fourier Integral
Theory (110). Problems (213). Hints (318).
4. Fourier Transformation of Generalized Functions
Theory (114). Problems (216). Hints (322).

Chapter V
The Spectral Theory of Operators

§1. The Functional Calculus
1. Functions of Operators in a Finite-Dimensional Space
Theory (116). Problems (219). Hints (325).
2. Functions of Bounded Selfadjoint Operators
Theory (118). Problems (222). Hints (327).
3. Unbounded Selfadjoint Operators
Theory (124). Problems (223). Hints (328).

§2. Spectral Decomposition of Operators
1. Reduction of an Operator to the Form of Multiplication by a Function
Theory (127). Problems (225). Hints (330).
2. The Spectral Theorem
Theory (131). Problems (227). Hints (332).

List of Notation 335

Bibliography 339

Subject Index 343