CONTENTS

Preface to the Second Edition xi

Preface to the First Edition xiii

0. Preliminaries 1

1. Heat Conduction, 3
2. Diffusion, 10
3. Reaction-Diffusion Problems, 13
4. The Impulse-Momentum Law: The Motion of Rods and Strings, 21
5. Alternative Formulations of Physical Problems, 33
6. Notes on Convergence, 41
7. The Lebesgue Integral, 46

1. Green's Functions (Intuitive Ideas) 53

1. Introduction and General Comments, 53
2. The Finite Rod, 62
3. Maximum Principle, 76
4. Examples of Green's Functions, 80

2. The Theory of Distributions 97

1. Basic Ideas, Definitions, Examples, 97
2. Convergence of Sequences and Series of Distributions, 118
3. Fourier Series, 138
4. Fourier Transforms and Integrals, 158
5. Differential Equations in Distributions, 179

3. One-Dimensional Boundary Value Problems 201

1. Review, 201
2. Boundary Value Problems for Second-Order Equations, 207
3. Boundary Value Problems for Equations of Order p, 219

4. Alternative Theorems, 223
5. Modified Green's Functions, 234

4. Hilbert and Banach Spaces 242

1. Functions and Transformations, 242
2. Linear Spaces, 246
3. Metric Spaces, Normed Linear Spaces, Banach Spaces, 253
4. Contractions, 265
5. Hilbert Spaces, 283
6. Separable Hilbert Spaces and Orthonormal Bases, 298
7. Linear Functionals, 312

5. Operator Theory 317

1. Basic Ideas and Examples, 317
2. Closed Operators, 325
3. Invertibility—The State of an Operator, 329
4. Adjoint Operators, 335
5. Solvability Conditions, 341
6. The Spectrum of an Operator, 346
7. Compact Operators, 357
8. Extremal Properties of Operators, 361

6. Integral Equations 370

1. Introduction, 370
2. Fredholm Integral Equations, 379
3. The Spectrum of a Self-Adjoint Compact Operator, 392
4. The Inhomogeneous Equation, 401
5. Variational Principles and Related Approximation Methods, 419

7. Spectral Theory of Second-Order Differential Operators 435

1. Introduction; the Regular Problem, 435
2. Weyl's Classification of Singular Problems, 461
3. Spectral Problems with a Continuous Spectrum, 474

8. Partial Differential Equations 491

1. Classification of Partial Differential Equations, 491
2. Typical Well-Posed Problems for Hyperbolic and Parabolic Equations, 505
3. Elliptic Equations, 525
4. Variational Principles for Inhomogeneous Problems, 553

9. Nonlinear Problems **597**

1. Introductory Concepts, 597
2. Branching Theory, 618
3. Perturbation Theory for Linear Problems, 626
4. Techniques for Nonlinear Problems, 638
5. The Stability of the Steady State, 670

Index **683**