

Contents

	Preface	vii
	Introduction	1
1	SPECIAL FUNCTIONS	6
1.1	Introduction	6
1.2	The Gamma Function	7
1.3	The Error Function and Related Functions	16
1.4	Bessel Functions	21
1.5	Useful Engineering Functions	29
2	FOURIER INTEGRALS AND FOURIER TRANSFORMS	37
2.1	Introduction	37
2.2	Fourier Integral Representations	38
2.3	Proof of the Fourier Integral Theorem	47
2.4	Fourier Transform Pairs	49
2.5	Properties of the Fourier Transform	58
2.6	Transforms of More Complicated Functions	65
2.7	The Convolution Integrals of Fourier	78
2.8	Transforms Involving Generalized Functions	85
2.9	Hilbert Transforms	91
2.10	Additional Topics	97
3	APPLICATIONS INVOLVING FOURIER TRANSFORMS	102
3.1	Introduction	102
3.2	Boundary Value Problems	103
3.3	Heat Conduction in Solids	113
3.4	Mechanical Vibrations	125
3.5	Potential Theory	131
3.6	Hydrodynamics	141
3.7	Elasticity in Two Dimensions	151
3.8	Probability and Statistics	156
4	THE LAPLACE TRANSFORM	162
4.1	Introduction	162
4.2	The Transforms of Some Typical Functions	164

4.3	Basic Operational Properties	170
4.4	Transforms of More Complicated Functions	182
4.5	The Inverse Laplace Transform	190
4.6	Complex Inversion Formula	200
4.7	Additional Topics	210
5	APPLICATIONS INVOLVING LAPLACE TRANSFORMS	218
5.1	Introduction	218
5.2	Evaluating Integrals	218
5.3	Solutions of ODEs	221
5.4	Solutions of PDEs	229
5.5	Linear Integral Equations	238
6	THE MELLIN TRANSFORM	245
6.1	Introduction	245
6.2	Evaluation of Mellin Transforms	246
6.3	Complex Variable Methods	254
6.4	Applications	262
6.5	Table of Mellin Transforms	273
7	THE HANKEL TRANSFORM	274
7.1	Introduction	274
7.2	Evaluation of Hankel Transforms	276
7.3	Applications	285
7.4	Table of Hankel Transforms	290
8	FINITE TRANSFORMS	291
8.1	Introduction	291
8.2	Finite Fourier Transforms	291
8.3	Sturm–Liouville Transforms	298
8.4	Finite Hankel Transform	303
9	DISCRETE TRANSFORMS	310
9.1	Introduction	310
9.2	Discrete Fourier Transform	311
9.3	The Z Transform	321
9.4	Difference Equations	330
9.5	Table of Z Transforms	333
	BIBLIOGRAPHY	335
	APPENDIX A: REVIEW OF COMPLEX VARIABLES	337
	APPENDIX B: TABLE OF FOURIER TRANSFORMS	340
	APPENDIX C: TABLE OF LAPLACE TRANSFORMS	344
	INDEX	349