

Contents

1. The Laplace Transform	1
1.1 Introduction	1
1.2 The Laplace Transform	2
1.3 Elementary Properties	5
1.4 Exercises	11
2. Further Properties of the Laplace Transform	13
2.1 Real Functions	13
2.2 Derivative Property of the Laplace Transform	14
2.3 Heaviside's Unit Step Function	18
2.4 Inverse Laplace Transform	19
2.5 Limiting Theorems	23
2.6 The Impulse Function	25
2.7 Periodic Functions	32
2.8 Exercises	34
3. Convolution and the Solution of Ordinary Differential Equations	37
3.1 Introduction	37
3.2 Convolution	37
3.3 Ordinary Differential Equations	49
3.3.1 Second Order Differential Equations	54
3.3.2 Simultaneous Differential Equations	63
3.4 Using Step and Impulse Functions	68
3.5 Integral Equations	73
3.6 Exercises	75
4. Fourier Series	79
4.1 Introduction	79
4.2 Definition of a Fourier Series	81

4.3	Odd and Even Functions	91
4.4	Complex Fourier Series	94
4.5	Half Range Series	96
4.6	Properties of Fourier Series	101
4.7	Exercises	108
5.	Partial Differential Equations	111
5.1	Introduction	111
5.2	Classification of Partial Differential Equations	113
5.3	Separation of Variables	115
5.4	Using Laplace Transforms to Solve PDEs	118
5.5	Boundary Conditions and Asymptotics	123
5.6	Exercises	126
6.	Fourier Transforms	129
6.1	Introduction	129
6.2	Deriving the Fourier Transform	129
6.3	Basic Properties of the Fourier Transform	134
6.4	Fourier Transforms and PDEs	142
6.5	Signal Processing	146
6.6	Exercises	153
7.	Complex Variables and Laplace Transforms	157
7.1	Introduction	157
7.2	Rudiments of Complex Analysis	157
7.3	Complex Integration	160
7.4	Branch Points	167
7.5	The Inverse Laplace Transform	172
7.6	Using the Inversion Formula in Asymptotics	177
7.7	Exercises	181
A.	Solutions to Exercises	185
B.	Table of Laplace Transforms	227
C.	Linear Spaces	231
C.1	Linear Algebra	231
C.2	Gramm-Schmidt Orthonormalisation Process	243
	Bibliography	244
	Index	246

<http://www.springer.com/978-1-85233-015-6>

An Introduction to Laplace Transforms and Fourier
Series

Dyke, P.

2001, XII, 250 p. 2 illus., Softcover

ISBN: 978-1-85233-015-6