



Tata McGraw-Hill

Partial Differential Equations and Integral Transforms

For B. Sc. – IT and Computer Technology
M. Sc. – IT and Computer Technology

T Veerarajan



Partial Differential Equations and Integral Transforms

T Veerarajan

Professor and Head

Department of Mathematics

*RVS College of Engineering and Technology
Dindigul*



Tata McGraw-Hill Publishing Company Limited

NEW DELHI

McGraw-Hill Offices

New Delhi New York St Louis San Francisco Auckland Bogotá Caracas
Kuala Lumpur Lisbon London Madrid Mexico City Milan Montreal
San Juan Santiago Singapore Sydney Tokyo Toronto

Contents

Preface

v

1. Partial Differential Equations

1.1

1.1 Introduction 1.1

1.2 Formation of Partial Differential Equations 1.1

1.3 Elimination of Arbitrary Constants 1.2

1.4 Elimination of Arbitrary Functions 1.2

1.5 Solutions of Partial Differential Equations 1.21

1.6 Procedure to Find General Solution 1.22

1.7 Procedure to Find Singular Solution 1.23

1.8 Complete Solutions of First Order Non-Linear P.D.E.S 1.23

1.9 Equations Reducible to Standard Types—Transformation 1.26

1.10 General Solutions of Partial Differential Equations 1.50

1.11 Lagrange's Linear Equation 1.51

1.12 Solution of the Simultaneous Equations $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ 1.52

1.13 Linear P.D.E.S. of Higher Order with Constant Coefficients 1.71

1.14 Complementary Function for a Non-homogeneous Linear Equation 1.76

1.15 Solution of P.D.E.S. by the Method of Separation of Variables 1.76

2. Fourier Series

2.1

2.1 Introduction 2.1

2.2 Dirichlet's Conditions 2.2

2.3 Euler's Formulas 2.2

2.4 Definition of Fourier Series 2.5

2.5 Important Concepts 2.5

2.6 Fourier Series of Even and Odd Functions 2.8

2.7 Theorem 2.9

2.8 Convergence of Fourier Series at Specific Points 2.11

2.9 Half-range Fourier Series and Parseval's Theorem 2.42

2.10 Root-mean Square Value of a Function 2.45

2.11 Harmonic Analysis 2.73

2.12 Complex Form of Fourier Series 2.75

3. Fourier Transforms	3.1
3.1 Introduction	3.1
3.2 Fourier Integral Theorem	3.1
3.3 Fourier Transforms	3.4
3.4 Alternative Form of Fourier Complex Integral Formula	3.6
3.5 Relationship Between Fourier Transform and Laplace Transform	3.7
3.6 Properties of Fourier Transforms	3.26
3.7 Finite Fourier Transforms	3.55
4. Laplace Transforms	4.1
4.1 Introduction	4.1
4.2 Linearity Property of Laplace and Inverse Laplace Transforms	4.2
4.3 Laplace Transforms of Some Elementary Functions	4.3
4.4 Laplace Transforms of Some Special Functions	4.7
4.5 Properties of Laplace Transforms	4.9
4.6 Laplace Transform of Periodic Functions	4.37
4.7 Derivatives and Integrals of Transforms	4.38
4.8 Laplace Transforms of Derivatives and Integrals	4.66
4.9 Initial and Final Value Theorems	4.69
4.10 The Convolution	4.71
4.11 Solution of Differential and Integral Equations	4.100
5. Z-Transforms	5.1
5.1 Introduction	5.1
5.2 Properties of Z-Transforms	5.2
5.3 Z-Transforms of Some Basic Functions	5.7
5.4 Inverse Z-Transforms	5.26
5.5 Use of Z-Transforms to Solve Finite Difference Equations	5.27
Index	I.1-I.2

1.1 D

Partial d
conducti
ordinary
tion cont
Partial d
is a func
equation
However
independ
x and y
standard

The orde
occurring

1.2 F

Though c
taneous i
formation
of solutio
either art
the dependen
the follow

1. If t
ind
eqt