CONTENTS

PREFACE **xiii**

1 PREREQUISITES **1**

I **Real Number System** **1**
1 Natural Numbers 1
2 Integers 1
3 Rational Numbers 2
4 Prime and Composite Numbers 2
5 Algebraic and Transcendental Numbers 2

II **Complex Numbers** **3**
1 Complex Number 3
2 Algebraic Laws of Complex Numbers 3
3 Modulus and Argument of z 4
4 Properties of Complex Numbers 4
5 Geometrical Representation of Complex Numbers 5
6 Logarithm of a Complex Number 8

III **Algebraic Group** **9**
1 Some Algebraic Structures 9
2 Some Properties of Groups 10
3 Some Special Types of Groups 16

IV **Vector Algebra** **20**
1 Physical Quantities 20
2 Scalar Multiplication of a Vector 22
3 Components of a Vector Along the Coordinate Axes 24
4 Products of Two Vectors 26
5 Products of Three Vectors 32

V **Differentiation of Vectors** **35**
1 Derivation of a Vector 35
2 Some Identities 36

2 ORDINARY DIFFERENTIAL EQUATIONS **39**

1 Introduction 39
2 Differential Equation of 1st Order and 1st Degree 40
3 Differential Equations of the 1st Order but of Any Degree 48

	4	Linear Differential Equations of Any Order with Constant Coefficients	54
	5	The Particular Integral	58
	6	Homogeneous Linear Differential Equations of Any Order	68
	7	Differential Equations Reducible to Homogeneous Linear Form	72
	8	Simultaneous Differential Equations	74
	9	Solution of ODE by Variation of Parameters Method	80
	10	Problem Set	84
3	**BILINEAR (OR MÖBIUS) TRANSFORMATIONS**		**105**
	1	Introduction	105
4	**MULTI-VALUED FUNCTIONS**		**111**
	1	History	111
	2	Introduction	111
	3	Set–valued Analysis	113
	4	Types of Multivalued Functions	114
	5	Applications	114
5	**INTEGRAL REPRESENTATION OF FUNCTIONS**		**115**
	1	Introduction	115
	2	Bessel's Equation	115
6	**LAPLACE TRANSFORMS OF FUNCTIONS**		**119**
	1	Integral Transform	119
	2	Laplace Transform of Some Standard Functions	119
	3	Some Properties of Laplace Transforms	121
	4	Examples Based on Above Properties of Laplace Transforms	123
	5	Laplace Transform of Derivative of a Function	125
	6	Laplace Transform of Integrals	127
	7	Laplace Transform of a Function $t^n F(t)$	129
	8	Laplace Transform of a Function $F(t)$ Divided by t	130

	9	Two Important Theorems	133
	10	Laplace Transforms of Some Special Functions	134
	11	Problem Set	141
7	**INVERSE LAPLACE TRANSFORM**		**145**
	1	Introduction	145
	2	Properties of Inverse Laplace Transform	146
	3	Methods to Find Inverse Laplace Transforms	149
	4	Inverse Laplace Transforms of Derivatives and Integrals	152
	5	Convolution Theorem	155
	6	Problem Set	158
8	**APPLICATIONS OF LAPLACE TRANSFORMS TO DIFERENTIAL EQUATIONS**		**167**
	1	Introduction	167
	2	Solution of ODE with Constant Coefficients by Laplace Transform Methods	167
	3	Solution of ODE with Variable Coefficients	172
	4	Problem Set	174
9	**FOURIER TRANSFORMS OF FUNCTIONS**		**185**
	1	Introduction	185
	2	Properties of the Fourier Transform	186
	3	Fourier Series	186
	4	Evaluation of Fourier Coefficients	187
	5	Fourier Series in any Interval	194
	6	Fourier Series for Piecewise Defined Functions	204
10	**GREEN'S FUNCTION FOR LAPLACIAN OPERATOR**		**213**
	1	Laplace Equation	213
	2	Green's Theorem	214
11	**DIFFUSION EQUATION**		**217**
	1	The Diffusion Equation	217

2 Heat Equation 217

12 GREEN'S FUNCTION FOR THE HELMHOLTZ OPERTOR 221

1 Introduction 221

13 PARTIAL DIFFERENTIATION & WAVE EQUATION 223

1 Introduction 223
2 Separation of Variables 225
3 One-dimensional Wave Equation 228

14 THE ROTATION GROUP 235

1 Translation 235
2 Reflection 236
3 Rotation 238
4 Isometries 239
5 Groups of Transformations 240

15 NON–RELATIVISTIC SCATERING OF MATTER 243

1 Introduction 243

BIBLIOGRAPHY 247

INDEX 249