Contents

	vii
x Numbers and Functions	1
 .2 The Complex Plane 11 .3 Polar Form 23 .4 Complex Functions 37 .5 The Complex Exponential 45 .6 Trigonometric and Hyperbolic Functions 55 	
c Functions	73
2 Limits and Continuity 81 3 Analytic Functions 91 4 The Cauchy–Riemann Equations 100	
pplement on Calculus of Functions of Several Variables	
6 Differentiation of Functions of Several Variables 129	
x Integration	135
2 Complex Integration 144 3 Independence of Path 163 4 Cauchy's Integral Theorem 171 5 Proof of Cauchy's Integral Theorem 192 6 Cauchy's Integral Formula 201 7 Bounds for Moduli of Analytic Functions 212 8 Applications to Harmonic Functions 221	
	2 The Complex Plane 11 3 Polar Form 23 4 Complex Functions 37 5 The Complex Exponential 45 6 Trigonometric and Hyperbolic Functions 55 7 Logarithms and Powers 65 6 Functions 1 Regions of the Complex Plane 74 1 Limits and Continuity 81 3 Analytic Functions 91 4 The Cauchy-Riemann Equations 100 5 Harmonic Functions and Laplace's Equation 108 pplement on Calculus of Functions of Several Variables 6 Differentiation of Functions of Several Variables 1 Contours and Path's in the Complex Plane 136 2 Complex Integration 144 3 Independence of Path 163 4 Cauchy's Integral Theorem 171 5 Proof of Cauchy's Integral Theorem 192 6 Cauchy's Integral Formula 201 7 Bounds for Moduli of Analytic Functions 212

4/	Complex Series	239
	4.1 Sequences and Series of Complex Numbers 240 4.2 Sequences and Series of Functions 253 4.3 Power Series 264 4.4 Taylor Series 274 4.5 Laurent Series 287 4.6 Zeros and Poles 297 4.7 Harmonic Functions and Fourier Series 311	
5	Residue Theory	319
	 5.1 Cauchy's Residue Theorem 320 5.2 Definite Integrals of Trigonometric Functions 329 5.3 Improper Integrals Involving Rational and Exponential Functions 5.4 Improper Integrals of Products of Rational and Trigonometric Functions 343 5.5 Advanced Integrals by Residues 354 5.6 Summing Series by Residues 365 5.7 The Counting Theorem and Rouché's Theorem 370 	333
6	Conformal Mappings	385
	 6.1 Basic Properties 386 6.2 Linear Fractional Transformations 393 6.3 Solving Dirichlet Problems with Conformal Mappings 412 6.4 The Schwarz-Christoffel Transformation 423 6.5 Green's Functions 434 6.6 Poisson's Equation and Neumann Problems 445 	
7	Fourier Series	457
	 7.1 Periodic Functions 458 7.2 Fourier Series 462 7.3 Fourier Series With Arbitrary Period 477 7.4 Half-Range Expansions 488 7.5 Complex Form of Fourier Series 491 7.6 Proof of the Fourier Representation Theorem 503 	
8	Partial Differential Equations in Rectangular Coordinates	508
	 8.1 Partial Differential Equations in Physics and Engineering 509 8.2 Solution of the One Dimensional Wave Equation: The Method of Separation of Variables 515 	

	8.4 8.5 8.6 8.7	The One Dimensional Heat Equation 528 Heat Conduction in Bars: Varying the Boundary Conditions Two Dimensional Wave and Heat Equations 544 Laplace's Equation in Rectangular Coordinates 553 The Method of Eigenfunction Expansions 562 Neumann Problems and Robin Conditions 573	536
9		Differential Equations and Cylindrical Coordinates	579
	9.2 9.3 9.4	Laplace's Equation in Polar Coordinates 580 Vibrations of a Circular Membrane: Symmetric Case 587 Vibrations of a Circular Membrane: General Case 596 Steady-State Temperature in a Cylinder 607 The Helmholtz and Poisson Equations 610	
	Supp	plement on Bessel Functions and Series Expansions	
		Bessel's Equation and Bessel Functions 616 Bessel Series Expansions 625	
10	Partial Di	ifferential Equations in Spherical Coordinates	638
	$10.2 \\ 10.3$	Preview of Problems and Methods 639 Dirichlet Problems with Symmetry 644 Spherical Harmonics and the General Dirichlet Problem 651 The Helmholtz Equation with Applications to the Poisson, Heat, and Wave Equations 661	
	Supp	plement on Legendre Functions and Series Expansions	
	10.6	Legendre's Differential Equation and Legendre Polynomials Legendre Series 682 Associated Legendre Functions and Series Expansions 689	669
11	The Fou	rier Transform and its Applications	695
	11.2 11.3 11.4 11.5 11.6	The Fourier Transform 696 Operational Properties 708 The Fourier Transform Method 725 The Heat Equation and Gauss's Kernel 733 The Poisson Integral and the Hilbert Transform 740 The Fourier Cosine and Sine Transforms 747	
	11.7	Problems Involving Semi-Infinite Intervals 754	

12	The Laplace and Hankel Transforms with Applications	759
	 12.1 The Laplace Transform 760 12.2 Further Properties of the Laplace Transform 771 12.3 The Laplace Transform Method 780 	
	12.4 The Hankel Transform with Applications 787	
APP.	ENDIXES	319
11	Ordinary Differential Equations: Review of Concepts and Methods	793
	 A.1 Linear Ordinary Differential Equations 794 A.2 Linear Ordinary Differential Equations with Constant Coefficients 802 A.3 Methods for Solving Ordinary Differential Equations 811 A.4 The Method of Power Series 818 A.5 The Method of Frobenius 826 	
В	Tables of Transforms	
	B.1 Fourier Transforms 840	
s Expan	B.2 Fourier Cosine Transforms 842 B.3 Fourier Sine Transforms 843	
	B.4 Laplace Transforms 844	
	Bibliography	847
	Answers to Selected Exercises	849
	Index	867