

# CONTENTS

	Page
<b>Chapter 1</b> <b>REVIEW OF FUNDAMENTAL CONCEPTS</b> .....	<b>1</b>
Real numbers. Rules of algebra. Functions. Special types of functions. Limits. Continuity. Derivatives. Differentiation formulas. Integrals. Integration formulas. Sequences and series. Uniform convergence. Taylor series. Functions of two or more variables. Partial derivatives. Taylor series for functions of two or more variables. Linear equations and determinants. Maxima and minima. Method of Lagrange multipliers. Leibnitz's rule for differentiating an integral. Multiple integrals. Complex numbers.	
<hr/>	
<b>Chapter 2</b> <b>ORDINARY DIFFERENTIAL EQUATIONS</b> .....	<b>38</b>
Definition of a differential equation. Order of a differential equation. Arbitrary constants. Solution of a differential equation. Differential equation of a family of curves. Special first order equations and solutions. Equations of higher order. Existence and uniqueness of solutions. Applications of differential equations. Some special applications. Mechanics. Electric circuits. Orthogonal trajectories. Deflection of beams. Miscellaneous problems. Numerical methods for solving differential equations.	
<hr/>	
<b>Chapter 3</b> <b>LINEAR DIFFERENTIAL EQUATIONS</b> .....	<b>71</b>
General linear differential equation of order $n$ . Existence and uniqueness theorem. Operator notation. Linear operators. Fundamental theorem on linear differential equations. Linear dependence and Wronskians. Solutions of linear equations with constant coefficients. Non-operator techniques. The complementary or homogeneous solution. The particular solution. Method of undetermined coefficients. Method of variation of parameters. Operator techniques. Method of reduction of order. Method of inverse operators. Linear equations with variable coefficients. Simultaneous differential equations. Applications.	
<hr/>	
<b>Chapter 4</b> <b>LAPLACE TRANSFORMS</b> .....	<b>98</b>
Definition of a Laplace transform. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transforms. Inverse Laplace transforms. Laplace transforms of derivatives. The unit step function. Some special theorems on Laplace transforms. Partial fractions. Solutions of differential equations by Laplace transforms. Applications to physical problems. Laplace inversion formulas.	
<hr/>	
<b>Chapter 5</b> <b>VECTOR ANALYSIS</b> .....	<b>121</b>
Vectors and scalars. Vector algebra. Laws of vector algebra. Unit vectors. Rectangular unit vectors. Components of a vector. Dot or scalar product. Cross or vector product. Triple products. Vector functions. Limits, continuity and derivatives of vector functions. Geometric interpretation of a vector derivative. Gradient, divergence and curl. Formulas involving $\nabla$ . Orthogonal curvilinear coordinates. Jacobians. Gradient, divergence, curl and Laplacian in orthogonal curvilinear. Special curvilinear coordinates.	

	Page
<p><b>Chapter 6</b>    <b>MULTIPLE, LINE AND SURFACE INTEGRALS AND INTEGRAL THEOREMS</b> .....</p> <p>Double integrals. Iterated integrals. Triple integrals. Transformations of multiple integrals. Line integrals. Vector notation for line integrals. Evaluation of line integrals. Properties of line integrals. Simple closed curves. Simply and multiply-connected regions. Green's theorem in the plane. Conditions for a line integral to be independent of the path. Surface integrals. The divergence theorem. Stokes' theorem.</p>	147
<hr/>	
<p><b>Chapter 7</b>    <b>FOURIER SERIES</b> .....</p> <p>Periodic functions. Fourier series. Dirichlet conditions. Odd and even functions. Half range Fourier sine or cosine series. Parseval's identity. Differentiation and integration of Fourier series. Complex notation for Fourier series. Complex notation for Fourier series. Orthogonal functions.</p>	182
<hr/>	
<p><b>Chapter 8</b>    <b>FOURIER INTEGRALS</b> .....</p> <p>The Fourier integral. Equivalent forms of Fourier's integral theorem. Fourier transforms. Parseval's identities for Fourier integrals. The convolution theorem.</p>	201
<hr/>	
<p><b>Chapter 9</b>    <b>GAMMA, BETA AND OTHER SPECIAL FUNCTIONS</b> .....</p> <p>The gamma function. Table of values and graph of the gamma function. Asymptotic formula for <math>\Gamma(n)</math>. Miscellaneous results involving the gamma function. The beta function. Dirichlet integrals. Other special functions. Error function. Exponential integral. Sine integral. Cosine integral. Fresnel sine integral. Fresnel cosine integral. Asymptotic series or expansions.</p>	210
<hr/>	
<p><b>Chapter 10</b>    <b>BESSEL FUNCTIONS</b> .....</p> <p>Bessel's differential equation. Bessel functions of the first kind. Bessel functions of the second kind. Generating function for <math>J_n(x)</math>. Recurrence formulas. Functions related to Bessel functions. Hankel functions of first and second kinds. Modified Bessel functions. Ber, bei, ker, kei functions. Equations transformed into Bessel's equation. Asymptotic formulas for Bessel functions. Zeros of Bessel functions. Orthogonality of Bessel functions. Series of Bessel functions.</p>	224
<hr/>	
<p><b>Chapter 11</b>    <b>LEGENDRE FUNCTIONS AND OTHER ORTHOGONAL FUNCTIONS</b> .....</p> <p>Legendre's differential equation. Legendre polynomials. Generating function for Legendre polynomials. Recurrence formulas. Legendre functions of the second kind. Orthogonality of Legendre polynomials. Series of Legendre polynomials. Associated Legendre functions. Other special functions. Hermite polynomials. Laguerre polynomials. Sturm-Liouville systems.</p>	242
<hr/>	
<p><b>Chapter 12</b>    <b>PARTIAL DIFFERENTIAL EQUATIONS</b> .....</p> <p>Some definitions involving partial differential equations. Linear partial differential equations. Some important partial differential equations. Heat conduction equation. Vibrating string equation. Laplace's equation. Longitudinal vibrations of a beam. Transverse vibrations of a beam. Methods of solving boundary-value problems. General solutions. Separation of variables. Laplace transform methods.</p>	258

	Page
<p><b>Chapter 13</b>    <b>COMPLEX VARIABLES AND CONFORMAL MAPPING</b> . . . . .</p> <p>Functions. Limits and continuity. Derivatives. Cauchy-Riemann equations. Integrals. Cauchy's theorem. Cauchy's integral formulas. Taylor's series. Singular points. Poles. Laurent's series. Residues. Residue theorem. Evaluation of definite integrals. Conformal mapping. Riemann's mapping theorem. Some general transformations. Mapping of a half plane on to a circle. The Schwarz-Christoffel transformation. Solutions of Laplace's equation by conformal mapping.</p>	286
<p><b>Chapter 14</b>    <b>COMPLEX INVERSION FORMULA FOR LAPLACE TRANSFORMS</b> . . . . .</p> <p>The complex inversion formula. The Bromwich contour. Use of residue theorem in finding inverse Laplace transforms. A sufficient condition for the integral around <math>\Gamma</math> to approach zero. Modification of Bromwich contour in case of branch points. Case of infinitely many singularities. Applications to boundary-value problems.</p>	324
<p><b>Chapter 15</b>    <b>MATRICES</b> . . . . .</p> <p>Definition of a matrix. Some special definitions and operations involving matrices. Determinants. Theorems on determinants. Inverse of a matrix. Orthogonal and unitary matrices. Orthogonal vectors. Systems of linear equations. Systems of <math>n</math> equations in <math>n</math> unknowns. Cramer's rule. Eigenvalues and eigenvectors. Theorems on eigenvalues and eigenvectors.</p>	342
<p><b>Chapter 16</b>    <b>CALCULUS OF VARIATIONS</b> . . . . .</p> <p>Maximum or minimum of an integral. Euler's equation. Constraints. The variational notation. Generalizations. Hamilton's principle. Lagrange's equations. Sturm-Liouville systems and Rayleigh-Ritz methods. Operator interpretation of matrices.</p>	375
<p><b>INDEX</b> . . . . .</p>	399