

Contents

Preface, vii

- 1 VECTOR ALGEBRA** **1**
- 1.1 Definitions, 1 1.2 Addition and Subtraction, 3 1.3 Multiplication of Vectors by Numbers, 5 1.4 Cartesian Coordinates, 7 1.5 Space Vectors, 9 1.6 Digression, 11 1.7 Some Problems in Geometry, 14 1.8 Equations of a Line, 19 1.9 Scalar Products, 22 1.10 Equation of a Plane, 25 1.11 Orientation, 29 1.12 Vector Products, 31 1.13 Triple Scalar Products, 38 1.14 Vector Identities, 42 *1.15 Tensor Notation, 44*
- 2 VECTOR FUNCTIONS OF A SINGLE VARIABLE** **49**
- 2.1 Differentiation, 49 2.2 Space Curves, 52 2.3 Velocity and Acceleration, 63 2.4 Planar Motion in Polar Coordinates, 73 *2.5 Tensor Notation, 77*
- 3 SCALAR AND VECTOR FIELDS** **78**
- 3.1 Scalar Fields; Isotimic Surfaces; Gradient, 78 3.2 Vector Fields and Flow Lines, 85 3.3 Divergence, 88 3.4 Curl, 95 3.5 Del Notation, 100 3.6 The Laplacian, 103 3.7 Vector Identities, 106 *3.8 Tensor Notation, 111*

4	LINE AND SURFACE INTEGRALS	113
	4.1 <i>Line Integrals</i> , 113 4.2 <i>Domains; Simply-Connected Domains</i> , 119 4.3 <i>Conservative Fields</i> , 123 4.4 <i>Conservative Fields (Continued)</i> , 130 *4.5 <i>Vector Potentials</i> , 136 4.6 <i>Oriented Surfaces</i> , 139 4.7 <i>Surface Integrals</i> , 147 4.8 <i>Volume Integrals</i> , 158 4.9 <i>Introduction to the Divergence Theorem and Stokes' Theorem</i> , 164 4.10 <i>The Divergence Theorem</i> , 171 4.11 <i>Green's Theorem</i> , 177 4.12 <i>Stokes' Theorem</i> , 183 4.13 <i>Orthogonal Curvilinear Coordinates</i> , 187	
5	ADVANCED TOPICS	197
	5.1 <i>Introduction</i> , 197 5.2 <i>Differential Forms</i> , 198 5.3 <i>The Generalized Stokes Theorem</i> , 205 5.4 <i>Matrices</i> , 210 5.5 <i>Bases</i> , 219 5.6 <i>Tensors of Rank Two</i> , 225 5.7 <i>Tensor Algebra</i> , 230 5.8 <i>General Curvilinear Coordinates</i> , 238 5.9 <i>Tensor Analysis in Three Dimensions</i> , 249 5.10 <i>Coordinate Transformations</i> , 260 5.11 <i>Historical Notes</i> , 275	
	<i>Review Problems</i> , 281	
	<i>Appendix</i> , 287	
	<i>Answers and Notes</i> , 291	
	<i>Index</i> , 325	