CONTENTS

| | | | | | | | | | | | | | | Pe | ag e |
|--------------|--|--|--|--|--|--|---|--|--|--|--|--|--|----|-------------|
| Preface | | | | | | | • | | | | | | | | 9 |
| Introduction | | | | | | | | | | | | | | | 10 |

PART ONE. STATICS OF RIGID BODIES

| Chapter 1. Basic Concepts and Principles | |
|--|---|
| 1. The Subject of Statics2. Force3. Fundamental Principles4. Constraints and Their Reactions5. Axiom of Constraints | $13 \\ 14 \\ 16 \\ 19 \\ 22$ |
| Chapter 2. Concurrent Force Systems | |
| 6. Geometrical Method of Composition of Concurrent Forces 7. Resolution of Forces 8. Projection of a Force on an Axis and on a Plane 9. Analytical Method of Defining a Force 10. Analytical Method for the Composition of Forces 11. Equilibrium of a System of Concurrent Forces 12. Problems Statically Determinate and Statically Indeterminate 13. Solution of Problems of Statics 14. Moment of a Force About an Axis (or a Point) 15. Varignon's Theorem of the Moment of a Resultant 16. Equations of Moments of Concurrent Forces | $\begin{array}{c} 23 \\ 25 \\ 28 \\ 30 \\ 31 \\ 32 \\ 34 \\ 35 \\ 43 \\ 45 \\ 46 \end{array}$ |
| Chapter 3. Parallel Forces and Couples in a Plane | |
| Composition and Resolution of Parallel Forces Force Couples. Moment of a Couple Equivalent Couples Composition of Coplanar Couples. Conditions for the Equilibrium | 47 50 51 |
| of Couples | 53 |
| Chapter 4. General Case of Forces in a Plane | |
| Theorem of the Translation of a Force to a Parallel Position Reduction of a Coplanar Force System to a Given Centre Reduction of a Coplanar Force System to the Simplest Possible | 55 56 |
| 24. Conditions for the Equilibrium of a Coplanar Force System 25. Equilibrium of a Coplanar System of Parallel Forces | 58 61 63 63 70 74 |

| 30. Graphical Determination of a Resultant | 78 80 81 81 82 85 |
|---|----------------------------------|
| 37. Reactions of Rough Constraints. Angle of Friction | 86 88 89 92 94 |
| Chapter 7. Couples and Forces in Space 41. Moment of a Force About a Point as a Vector | 95 |
| 42. Moment of a Force with Respect to an Axis | 97 00 01 |
| 45. Composition of Couples in Space. Conditions of Equilibrium of Couples | |
| 47. Reduction of a Force System in Space to the Simplest Possible Form 48. Condition of Equilibrium of an Arbitrary Force System in Space. | |
| 49. Varignon's Theorem of the Moment of a Resultant with Respect | 08 |
| to an Axis | |
| of Force Systems in Space | 17 |
| Chapter 8. Centre of Gravity 52. Centre of Parallel Forces | 22 |
| | |

PART 11. KINEMATICS OF A PARTICLE AND A RIGID BODY

Chapter 9. Rectilinear Motion of a Particle

| 57. | Introduction to Kinematics | 128 |
|-----|---|-----|
| 58. | Equation of Rectilinear Motion | 129 |
| 59. | Velocity and Acceleration of a Particle in Rectilinear Motion | 130 |
| 60. | Some Examples of Rectilinear Motion of a Particle | 132 |
| 61. | Graphs of Displacement, Velocity and Acceleration of a Particle | 134 |
| 62. | Solution of Problems | 135 |

Chapter 10. Curvilinear Motion of a Particle

| 63. Vector Method of Describing Motion of a Particle | 891 2781 |
|---|----------------------|
| Chapter 11. Translatory and Rotational Motion of a Rigid Body | |
| 73. Motion of Translation | 0 2 4 6 |
| Chapter 12. Plane Motion of a Rigid Body | |
| 77. Equations of Plane Motion. Resolution of Motion into Translation and Rotation | '3 |
| a Body | 75 78 32 34 |
| Chapter 13. Motion of a Rigid Body Having One Fixed Point and Mo- tion of a Free Rigid Body | |
| 86. Motion of a Rigid Body Having One Fixed Point , 19 87. Velocity and Acceleration of Any Point of a Body , 19 88. The Most General Motion of a Free Rigid Body |)5 |
| Chapter 14. Resultant Motion of a Particle | |
| 89. Relative, Transport, and Absolute Motion1990. Composition of Velocities2091. Composition of Accelerations. Coriolis Theorem2092. Calculation of Coriolis Acceleration2093. Solution of Problems20 | 0 |
| Chapter 15. Resultant Motion of a Rigid Body | |
| 94. Composition of Translatory Motions | .8 21 |

Contents

PART THREE. PARTICLE DYNAMICS

Chapter 16. Introduction to Dynamics. Laws of Dynamics

| Chapter 10. Infoduction to Dynamics. Laws of Dynamics |
|--|
| 99. Basic Concepts and Definitions226100. The Laws of Dynamics227101. Systems of Units230102. The Problems of Dynamics for a Free and a Constrained Particle 230103. Solution of the First Problem of Dynamics231 |
| Chapter 17. Differential Equations of Motion for a Particle and Their Integration |
| 104. Rectilinear Motion of a Particle |
| Chapter 18. General Theorems of Particle Dynamics |
| 109. Momentum and Kinetic Energy of a Particle248110. Impulse of a Force249111. Theorem of the Change in the Momentum of a Particle250112. Work Done by a Force. Power251113. Examples of Calculation of Work254114. Theorem of the Change in the Kinetic Energy of a Particle256115. Solution of Problems258116. Theorem of the Change in the Angular Momentum of a Particle264 |
| Chapter 19. Constrained Motion of a Particle and D'Alembert's Principle |
| 117. Equations of Motion of a Particle Along a Given Fixed Curve 268 118. Determination of the Reactions of Constraints |
| Chapter 20. Relative Motion of a Particle |
| 120. Equations of Relative Motion and Rest of a Particle 275 |
| 121. Effect of the Rotation of the Earth on the Equilibrium and Motion of Bodies |
| Motion of Bodies |
| Chapter 21. Vibration of a Particle |
| 123. Free Harmonic Motion |
| 124. The Simple Pendulum |
| Chapter 22. Motion of a Body in the Earth's Gravitational Field |
| 127. Motion of a Particle Thrown at an Angle to the Horizon in the |
| Earth's Gravitational Field |

PART IV. DYNAMICS OF A SYSTEM AND A RIGID BODY

Chapter 23. Introduction to the Dynamics of a System. Moments of Inertia of Rigid Bodies

| 129. Mechanical Systems. External and Internal Forces |
|--|
| Chapter 24. Theorem of the Motion of the Centre of Mass of a System 134. The Differential Equations of Motion of a System |
| Chapter 25. Theorem of the Change in the Linear Momentum of a System |
| 138. Linear Momentum of a System323139. Theorem of the Change in Linear Momentum324140. The Law of Conservation of Linear Momentum325141. Solution of Problems326142. Bodies Having Variable Mass. Motion of a Rocket329 |
| Chapter 26. Theorem of the Change in the Angular Momentum of a System |
| 143. Total Angular Momentum of a System |
| Chapter 27. Theorem of the Change in the Kinetic Energy of a System 147. Kinetic Energy of a System |
| Chapter 28. Some Cases of Rigid-Body Motion 153. Rotation of a Rigid Body |
| Chapter 29. D'Alembert's Principle. Forces Acting on the Axis of a Rotating Body |
| 158. D'Alembert's Principle for a System |

| 161. Dynamical Pressures on the Axis of a Rotating Body 162. The Principal Axes of Inertia of a Body. Dynamic Balancing of | 380 |
|--|--------------------------|
| Masses | 382 |
| Chapter 30. The Principle of Virtual Work and the General Equation of Dynamics | |
| 163. Virtual Displacements of a System. Degrees of Freedom164. Ideal Constraints165. The Principle of Virtual Work166. Solution of Problems167. The General Equation of Dynamics | 388 388 390 |
| Chapter 31. The Theory of Impact 168. The Fundamental Equation of the Theory of Impact 169. General Theorems of the Theory of Impact | 400 401 403 405 |
| Theorem | 407 |
| Name Index | |
| Subject Index | 414 |