

Contents

Preface

vii

1. Electron and Ion Optics

1. Introduction	1
-----------------	---

2. Geometrical Optics

2. Matrix Formulation	3
3. Rules for Image Formation	6
4. Beam Emittance and the Determinant	11
5. Types and Quality of Image Formation	22
6. Particle-Analyzing Systems	26

3. Scaling Rules and Dispersion Coefficients

7. Scaling Rules	35
8. Formulas for Deflection	38
9. Coefficients of Dispersion	40

4. Fields

10. Field Equations and Paraxial Fields	42
11. Sector, Fringing, and Quadrupole Fields	45

5. Lenses

12. Electrostatic Lenses	55
13. Acceleration System	58
14. Immersion Lenses and Unipotential Lenses	62
15. Magnetic Lenses	65
16. Quadrupole and Magnetic Fringing Field Lenses	67

6. Analyzers

17. Electrostatic Analyzer with Cylindrical Sector Field	73
18. Sector-Type Analyzer with Electric or Magnetic Field	77
19. Spherical Analyzer $E(2)$ and Sector Magnets $B(0)$, $B(1/2)$	89
20. Spectrographs	91
21. Analyzer with Homogeneous Electric Field	94
22. Coaxial Cylinder Analyzer	96
23. Magnetic Lens Spectrometer	101
24. Orange Spectrometer	102
25. Sector Magnet with Inclined Boundaries	103

7. Space Charge and Beam Production

26. Ideal Beam in a Drift Region	110
27. Focusing of a Nonideal Beam and Various Beam Effects	116
28. Electron Extraction	120
29. Ion Extraction	127

Problems

132

Bibliography

142

Index

143