Preface **ix**

Preface to First Edition **xiii**

1 Electrodynamics in Space **1**
1.1 Introduction 1
1.2 Solar and Stellar Winds 3
1.3 Interplanetary Magnetic Field 4
1.4 Interplanetary Electric Field 5
1.5 Solar and Stellar Activities 6
1.6 Collisionless Shock Waves 6
1.7 Magnetospheres of Cosmic Bodies 8
1.8 Magnetospheres of Planets 9
1.9 Heliosphere and Heliopause 16
1.10 Comparative Magnetospheres 18

2 Equations and Definitions **21**
2.1 Introduction 21
2.2 Maxwell Equations 21
2.3 Lorentz Equation of Motion 23
2.4 Statistical Concepts 23
2.5 Statistical Equations 26
2.6 Electrodynamics in Special Theory of Relativity 34
2.7 Electrodynamics in General Relativity 38
2.8 Charged Particles in Space 46
2.9 How to Study Plasma Phenomena in Space 48

3 Magnetic and Electric Fields in Space **51**
3.1 Introduction 51
3.2 Representations of Magnetic Fields 56
3.3 Magnetic Fields in Space 60
3.4 Inhomogeneous Magnetic Fields 68
3.5 Rotational Magnetic Fields 72
3.6 Spinning Magnetic Dipoles 78
3.7 Representations of Electric Fields 79
3.8 Electric Field of Rotating Dipoles 82
3.9 Plasmasphere and Plasmapause 90
3.10 Concluding Remarks 97

4 Particles in Space **103**
4.1 Introduction 103
4.2 Discovery of Earth's Radiation Belt 105
4.3 Lorentz Equation of Motion 110
4.4 Guiding Center Drift Equation 117
4.5 Motion in an Inhomogeneous Magnetic Field 121
4.6 Motion in Inhomogeneous Electric Field 127