CONTENTS

Duci	Page A																٠
Pref	lace	 	• •	 . 2	Χ1												
																 -	

Chapter 1	MACROSCOPIC KINETIC THEORY	
1.1	Introduction	
1.2	Distribution function and average values	3
1.3	The Boltzmann equation	6
1.4	Maxwell-Boltzmann distribution function	12
1.5	Steady state in the presence of an external force	
1.6	Particle current density	21
1.7	Kinetic pressure	24
1.8	Equation of continuity	27
1.9	Momentum transport equation	
1.10	Energy transport equation	
1.11	System of hydrodynamic equations	
1.12	Lumped macroscopic parameters and their governing	
	equations	51
	References	
	Problems	57

Chapter 2 BASIC PLASMA PHENOMENA

2.1	Introduction	.63
2.2	Electron plasma oscillations	
2.3	The Debye length	
2.4	Plasma sheath	
2.5	Plasma probe	.84
2.6	Generalized Poynting vector and group velocity	.86
2.7	Effect of thermal motions on electron plasma oscillations .	.92
2.8	Ion plasma oscillations	
2.9	MHD equations and their simple applications	
2.10	The pinch effect	
2.11	Configuration-space instability	128
2.12	Velocity-space instability	
	References	
	Problems	142

Chapter 3 INTERACTIONS OF CHARGED PARTICLES WITH ELECTROMAGNETIC FIELDS

3.1	Introduction	149
3.2	Constant and uniform electric field	152
3.3	Constant and uniform magnetic field	153
3.4	Constant and uniform electric and magnetic fields	159
3.5	Uniform and slowly time varying electric field	165
3.6	Uniform electric field with arbitrary time variation	
	and the conductivity dyad	168
3.7	Cyclotron resonance	175
3.8	Magnetic mirror effect	
3.9	Fermi acceleration	
3.10	Gradient and curvature drifts	
3.11	Magnetic pumping	194
3.12	Drift velocities and current densities	
	References	202
	Problems	202

Chapter 4 CLASSICAL DYNAMICS OF COLLISIONS

4.1	Introduction	209
4.2	Collision in the center-of-mass system	210
4.3	Equivalent one-body problem	
4.4	Inverse collision	
4.5	Scattering cross section	
4.6	Relationship to the laboratory system	
4.7	Collision between two perfectly elastic, hard spheres	229
4.8	Scattering by Coulomb potential	232
4.9	Effect of screening	
4.10	Mean free path and collision frequency	
	References	
	Problems	

Chapter 5 SMALL AMPLITUDE WAVES IN A PLASMA

249
256
n 258
n 275
ect to
heory. 294
5
314
ield
324
331
343
354

viii

Chapter 6	APPLICATIONS OF THE BOLTZMANN	
	EQUATION	
6.1	Introduction	59
6.2	Longitudinal plane plasma wave in a hot, isotropic	61
6.3	plasma	
6.4	isotropic plasma	84
6.5	Propagation across the magnetostatic field in a hot	
	plasma	95
6.6	Relaxation model for the collision term	07
6.7	Conductivity and diffusion for a constant collision	
	frequency	12
6.8	Ambipolar diffusion 4	16
6.9	Conductivity for a velocity-dependent collision frequency 4	23
6.10	Diffusion for a velocity-dependent collision frequency 4	
6.11	Integral expression for the collision term	
6.12	Boltzmann's H theorem	.39
6.13 6.14	Equilibrium velocity distribution function	40
	plasma	43
	References 4	
	Problems 4	46
Appendix A	Numerical values 4	57
Appendix B	Vector analysis 4	59
Appendix C	Vector relations 4	63
Appendix D	Dyads 4	65
Appendix E	Bessel functions	72

ix