

CONTENTS

	PAGE
1. AN INTRODUCTION TO PLASMA PHYSICS	1
1. Introduction	1
2. The Occurrence of Plasma in Nature	3
3. Technological Aspects of Plasma Physics	5
2. BASIC PROPERTIES OF THE EQUILIBRIUM PLASMA	9
1. Quasi-neutrality and Plasma Oscillations	9
2. The Transmission of Electromagnetic Radiation through Plasma	13
3. The Degree of Ionization in a Thermal Plasma	17
4. The Production of Plasma by Shock Waves	21
3. THE ARC PLASMA	25
1. The Diffusion Theory of the Positive Column	25
2. Sheath Formation	29
3. Ion Life	32
4. Magnetic Confinement—The Pinch Effect	37
4. MAGNETOHYDRODYNAMICS I	43
1. The Decay of Charge and Current in Conductors	43
2. The Equations of Magnetohydrodynamics	45
3. Immediate Consequences of the Magnetohydrodynamic Equations	48
4. Magnetohydrostatics	53
5. Magnetic Isolation of Plasma	54
6. Realization of Magnetic Confinement	58
5. MAGNETOHYDRODYNAMICS II	65
1. General Properties	65
2. Incompressible Flow—Particular Solutions	66
3. Alfvén Waves	69
4. Compressible Hartmann Flow and some Applications	70
5. Magnetosonic Waves	79
6. Propagation from a Point Source	85
7. Shocks	86

6. MAGNETOHYDRODYNAMIC STABILITY	97
1. The Concept of Stability	97
2. Convective Instabilities	99
3. The Formal Theory of Plasma Stability	111
4. The Stability of Cylindrical Confined Plasmas	117
5. Surface Instabilities and Stability Criterion	124
6. Thermal Convection in a Magnetic Field	129
7. PLASMA DYNAMICS AND PARTICLE MOTIONS	139
1. The Dielectric Behaviour of a Magnetized Plasma	139
2. Mean Free Paths in a Plasma	150
3. The Approximate Treatment of Particle Orbits	153
4. A Formal Derivation of the Drifts	158
5. Macroscopic Effects of Particle Motion	160
6. Some Consequences of the Magnetic Moment	165
8. KINETIC THEORY OF THE PLASMA	169
1. Transport Equations and Hydrodynamics	169
2. The Dielectric Properties of a Hot Plasma in the Absence of a Magnetic Field	180
3. Screening and the Fokker-Planck Equation for a Plasma	188
4. Electrostatic Instabilities	193
5. Equilibrium in a Magnetic Field. Some Exact Solutions	197
6. The Approximation Procedure for Solving the Transport Equations	199
7. The Magnetohydrodynamic Equations	208
8. Equilibrium Theory	211
9. Perturbation Theory	213
10. Low-frequency Oscillations of a Uniform Magnetized Plasma	214
11. Stability Theory	218
12. Further Developments of the Kinetic Theory	223
APPENDIXES	
I. Some Formulae	238
II. Some Numbers	245
III. Some Functions	247
PROBLEMS	249
ANSWERS TO PROBLEMS	252
AUTHOR INDEX	267
SUBJECT INDEX	271