CONTENTS

	Preface	ix
	Notation	x
	I. ELECTROSTATICS OF CONDUCTORS	
§1.	The electrostatic field of conductors	1
92. §3.	Methods of solving problems in electrostatics	9 9
§4.	A conducting ellipsoid	20
§5.	The forces on a conductor	31

II. ELECTROSTATICS OF DIELECTRICS

The electric field in dielectrics	36
The dielectric permeability	38
A dielectric ellipsoid	42
The dielectric permeability of a mixture	45
Thermodynamic relations for dielectrics in an electric field	47
The total free energy of a dielectric	52
Electrostriction of isotropic dielectrics	55
Dielectric properties of crystals	58
The sign of the dielectric susceptibility	63
Electric forces in a fluid dielectric	64
Electric forces in solids	69
Piezoelectrics	73
Thermodynamic inequalities	79
Ferroelectrics	83
	The electric field in dielectrics The dielectric permeability A dielectric ellipsoid The dielectric permeability of a mixture Thermodynamic relations for dielectrics in an electric field The total free energy of a dielectric Electrostriction of isotropic dielectrics Dielectric properties of crystals The sign of the dielectric susceptibility Electric forces in a fluid dielectric Electric forces in solids Piezoelectrics Thermodynamic inequalities Ferroelectrics

III. CONSTANT CURRENT

§20.	The current density and the conductivity	92
§21.	The Hall effect	96
§22.	The contact potential	99
§23.	The galvanic cell	101
§24.	Electrocapillarity	103
§25.	Thermoelectric phenomena	104
§26.	Diffusion phenomena	110

IV. CONSTANT MAGNETIC FIELD

Constant magnetic field	113
Magnetic symmetry of crystals	116
The magnetic field of a constant current	119
Thermodynamic relations in a magnetic field	126
The total free energy of a magnetic substance	129
The energy of a system of currents	131
	Constant magnetic field Magnetic symmetry of crystals The magnetic field of a constant current Thermodynamic relations in a magnetic field The total free energy of a magnetic substance The energy of a system of currents

Contents

		Page
§33.	The self-inductance of linear conductors	136
§34.	Forces in a magnetic field	141
§35.	Gyromagnetic phenomena	144

V. FERROMAGNETISM

§36.	Ferromagnetics near the Curie point	146
§37.	The magnetic anisotropy energy	149
§38.	Magnetostriction of ferromagnetics	155
§39.	The domain structure of ferromagnetics	158
š40.	The antiferromagnetic Curie point	165

VI. SUPERCONDUCTIVITY

§41.	The magnetic properties of superconductors	167
§42.	The superconductivity current	169
§43.	The critical field	173
§44.	The intermediate state	178

VII. QUASI-STATIC ELECTROMAGNETIC FIELD

Eddy currents	186
The skin effect	195
The complex resistance	197
Capacity in a quasi-steady current circuit	202
Motion of a conductor in a magnetic field	205
Excitation of currents by acceleration	210
	Eddy currents The skin effect The complex resistance Capacity in a quasi-steady current circuit Motion of a conductor in a magnetic field Excitation of currents by acceleration

VIII. MAGNETIC FLUID DYNAMICS

§51.	The equations of motion for a fluid in a magnetic field	213
§52.	Hydromagnetic waves	218
§53.	Tangential and rotational discontinuities	224
§54.	Shock waves	229
§55.	The spontaneous magnetic field in turbulent motion of a conducting	
0	fluid	234

IX. THE ELECTROMAGNETIC WAVE EQUATIONS

§56.	The field equations in a dielectric in the absence of dispersion	239
§57.	The electrodynamics of moving dielectrics	243
§58.	The dispersion of the dielectric permeability	247
§59.	The dielectric permeability at very high frequencies	251
§60.	The dispersion of the magnetic permeability	251
§61.	The field energy in dispersive media	253
§62.	The relation between the real and imaginary parts of $\epsilon(\omega)$	256
§63.	A plane wave of a single frequency	263
§64.	Transparent media	266
	V THE DRODACATION OF ELECTROMACNETIC WAVE	20

X. THE PROPAGATION OF ELECTROMAGNETIC WAVES

§65.	Geometrical optics	269
§66.	Reflection and refraction of electromagnetic waves	272
§67.	The surface impedance of metals	279

vi

§68. §69. §70. §71. §72. §73. §74. §75	The propagation of waves in an inhomogeneous medium The reciprocity principle Electromagnetic oscillations in hollow resonators The propagation of electromagnetic waves in waveguides The scattering of electromagnetic waves by small particles The absorption of electromagnetic waves by small particles Diffraction by a wedge Diffraction by a plane screen	Page 284 288 290 293 299 303 304 308
§75.	Diffraction by a plane screen	308

Contents

vii

XI. ELECTROMAGNETIC WAVES IN ANISOTROPIC MEDIA

§76.	The dielectric permeability of crystals	313
§77.	A plane wave in an anisotropic medium	315
§78.	Optical properties of uniaxial crystals	321
§79.	Biaxial crystals	324
§80.	Double refraction in an electric field	329
§81.	Mechanical-optical effects	330
§82.	Magnetic-optical effects	331
§83.	Natural optical activity	337

XII. THE PASSAGE OF FAST PARTICLES THROUGH MATTER

§84.	Ionisation losses by fast particles in matter: the non-relativistic case	344
§85.	Ionisation losses by fast particles in matter: the relativistic case	349
§86.	Cherenkov radiation	357

XIII. ELECTROMAGNETIC FLUCTUATIONS

§87.	Current fluctuations in linear circuits	360
§88.	Electromagnetic field fluctuations	361
§89.	Black-body radiation in a transparent medium	367
§90.	Forces of molecular attraction between solid bodies	368

XIV. SCATTERING OF ELECTROMAGNETIC WAVES

§91.	The general theory of scattering in isotropic media	377
§92.	The principle of detailed balancing applied to scattering	383
§93.	Scattering with small change of frequency	385
§94.	Rayleigh scattering in gases and liquids	387
§95.	Critical opalescence	393
§96.	Scattering in amorphous solids	395

XV. DIFFRACTION OF X-RAYS IN CRYSTALS

§97.	The general theory of X-ray diffraction	398
§98.	The integral intensity	404
§99.	Diffuse thermal scattering of X-rays	407
	Appendix	410
	Index	413