ELECTRICITY AND MAGNETISM

Chapter 1. Electric Fields

1.1 Introduction
1.2 Triboelectric Effect
1.3 Experiments with Pith Balls
1.4 Experiments with a Gold-leaf Electroscope
1.5 Coulomb's Law
1.6 Electric Field **E**
1.6.1 Field of a Point Charge
1.6.2 Spherical Charge Distributions
1.6.3 A Long, Charged Rod
1.6.4 Field on the Axis of a Ring Charge
1.6.5 Field on the Axis of a Uniformly Charged Disc
1.6.6 Field of a Uniformly Charged Infinite Plane Sheet
1.7 Electric Field **D**
1.8 Flux
1.9 Gauss's Theorem

Chapter 2. Electrostatic Potential

2.1 Introduction
2.2 Potential Near Various Charged Bodies
2.2.1 Point Charge
2.2.2 Spherical Charge Distributions
2.2.3 Long Charged Rod
2.2.4 Large Plane Charged Sheet
2.2.5 Axis of a Charged Ring
2.2.6 Axis of a Charged Disc
2.3 Electron-volts
2.4 A Point Charge and an Infinite Conducting Plane
2.5 A Point Charge and a Conducting Sphere
2.6 Two Semicylindrical Electrodes

Chapter 3. Dipole and Quadrupole Moments

3.1 Introduction
3.2 Mathematical Definition of Dipole Moment
3.3 Oscillation of a Dipole in an Electric Field
3.4 Potential Energy of a Dipole in an Electric Field
3.5 Force on a Dipole in an Inhomogeneous Electric Field
3.6 Induced Dipoles and Polarizability

3.7 The Simple Dipole
3.8 Quadrupole Moment
3.9 Potential at a Large Distance from a Charged Body

Chapter 4. Batteries, Resistors and Ohm's Law

4.1 Introduction
4.2 Resistance and Ohm's Law
4.3 Resistance and Temperature
4.4 Resistors in Series
4.5 Conductors in Parallel
4.6 Dissipation of Energy
4.7 Electromotive Force and Internal Resistance
4.8 Power Delivered to an External Resistance
4.9 Potential Divider
4.10 Ammeters and Voltmeters
4.11 Wheatstone Bridge
4.12 Delta-Star Transform
4.13 Kirchhoff's Rules
4.14 Tortures for the Brain
4.15 Solutions, Answers or Hints to 4.14

Chapter 5. Capacitors

5.1 Introduction
5.2 Plane Parallel Capacitor
5.3 Coaxial Cylindrical Capacitor
5.4 Concentric Spherical Capacitor
5.5 Capacitors in Parallel
5.6 Capacitors in Series
5.7 Delta-Star Transform
5.8 Kirchhoff's Rules
5.9 Problem for a Rainy Day
5.10 Energy Stored in a Capacitor
5.11 Energy Stored in an Electric Field
5.12 Force Between the Plates of a Plane Parallel Plate Capacitor
5.13 Sharing a Charge Between Two Capacitors
5.14 Mixed Dielectrics
5.15 Changing the Distance Between the Plates of a Capacitor
5.16 Inserting a Dielectric into a Capacitor
5.17 Polarization and Susceptibility
5.18 Discharging a Capacitor Through a Resistor
5.19 Charging a Capacitor Through a Resistor
5.20 Real Capacitors

Chapter 6. The Magnetic Effect of an Electric Current

6.1 Introduction
6.2 Definition of the Amp
6.3 Definition of the Magnetic Field
6.4 The Biot-Savart Law
6.5 Magnetic Field Near a Long, Straight, Current-carrying Conductor
6.6 Field on the Axis of a Plane Circular Current-carrying Coil
6.7 Helmholtz Coils
6.8 Field on the Axis of a Long Solenoid
6.9 The Magnetic Field *H*
6.10 Flux
6.11 Ampère's Theorem

Chapter 7. Force on a Current in a Magnetic Field

7.1 Introduction
7.2 Force Between Two Current-carrying Wires
7.3 The Permeability of Free Space
7.4 Magnetic Moment
7.5 Magnetic Moment of a Plane, Current-carrying Coil
7.6 Period of Oscillation of a Magnet or a Coil in an External Magnetic Field
7.7 Potential Energy of a Magnet or a Coil in a Magnetic Field
7.8 Moving-coil Ammeter
7.9 Magnetogyric Ratio

Chapter 8. On the Electrodynamics of Moving Bodies

8.1 Introduction
8.2 Charged Particle in an Electric Field
8.3 Charged Particle in a Magnetic Field
8.4 Charged Particle in an Electric and a Magnetic Field
8.5 Motion in a Nonuniform Magnetic Field
8A Appendix. Integration of the Equations

Chapter 9. Magnetic Potential

9.1 Introduction
9.2 The Magnetic Vector Potential
9.3 Long, Straight, Current-carrying Conductor

9.4 Long Solenoid
9.5 Divergence

Chapter 10. Electromagnetic Induction

10.1 Introduction
10.2 Electromagnetic Induction and the Lorentz Force
10.3 Lenz's Law
10.4 Ballistic Galvanometer and the Measurement of Magnetic Field
10.5 AC Generator
10.6 AC Power
10.7 Linear Motors and Generators
10.8 Rotary Motors
10.9 The Transformer
10.10 Mutual Inductance
10.11 Self Inductance
10.12 Growth of Current in a Circuit Containing Inductance
10.13 Discharge of a Capacitor through an Inductance
10.14 Discharge of a Capacitor through an Inductance and a Resistance
10.15 Energy Stored in an Inductance
10.16 Energy Stored in a Magnetic Field

Chapter 11. Dimensions

Chapter 12. Properties of Magnetic Materials

12.1 Introduction
12.2 Magnetic Circuits and Ohm's Law
12.3 Magnetization and Susceptibility
12.4 Diamagnetism
12.5 Paramagnetism
12.6 Ferromagnetism
12.7 Antiferromagnetism
12.8 Ferrimagnetism

Chapter 13. Alternating Current

13.1 Alternating current in an inductance
13.2 Alternating Voltage across a Capacitor
13.3 Complex Numbers
13.4 Resistance and Inductance in Series
13.5 Resistance and Capacitance in Series

13.6 Admittance
13.7 The RLC Series Acceptor Circuit
13.8 The RLC Parallel Rejector Circuit
13.9 AC Bridges
13.9.1 The Owen Bridge
13.9.2 The Schering Bridge
13.9.3 The Wien Bridge
13.10 The Transformer

Chapter 14. Laplace Transforms

14.1 Introduction
14.2 Table of Laplace Transforms
14.3 The First Integration Theorem
14.4 The Second Integration Theorem (Dividing a Function by t)
14.5 Shifting Theorem
14.6 A Function Times t^n
14.7 Differentiation Theorem
14.8 A First Order Differential Equation
14.9 A Second Order Differential Equation
14.10 Generalized Impedance
14.11 RLC Series Transient
14.12 Another Example

Chapter 15. Maxwell's Equations

15.1 Introduction
15.2 Maxwell's First Equation
15.3 Poisson's and Laplace's Equations
15.4 Maxwell's Second Equation
15.5 Maxwell's Third Equation
15.6 The Magnetic Equivalent of Poisson's Equation
15.7 Maxwell's Fourth Equation
15.8 Summary of Maxwell's and Poisson's Equations
15.9 Electromagnetic Waves

Chapter 16. CGS Electricity and Magnetism

16.1 Introduction
16.2 The CGS Electrostatic System
16.3 The CGS Electromagnetic System
16.4 The Gaussian Mixed System
16.5 Dimensions