

Detailed Course Outline

The course consists of almost everything in *Griffiths* up to and including most of chapter 7. Some of the topics will be supplemented by material from other sources.

Review of Mathematics

- 1.1 Vector Algebra
- 1.2 Vector Areas
- 1.3 The Scalar Product
- 1.4 The Vector Product
- 1.5 Rotation
- 1.6 The Scalar Triple Product
- 1.7 The Vector Triple Product
- 1.8 Vector Calculus
- 1.9 Line Integrals
- 1.10 Vector Line Integrals
- 1.11 Surface Integrals
- 1.12 Volume Integrals
- 1.13 Gradient
- 1.14 Divergence
- 1.15 The Laplacian
- 1.16 Curl

Review of Basics of Electrostatics

- 2.1 Study Guidelines
- 2.2 The Assumed Conditions for Electrostatics
- 2.3 Coulomb's Law and the Electric Field
- 2.4 Gauss's Law
- 2.5 The Electric Field has Vanishing Curl
- 2.6 The Electric Potential
- 2.7 Aside on Techniques
- 2.8 Boundary Conditions on the Electric Field and Potential
- 2.9 Poisson's and Laplace's Equations
- 2.10 Electrostatic Energy
- 2.11 Electric Conductors
- 2.12 Capacitors and Capacitance

Advanced Electrostatics

- 3.1 Intuitive Approach to Laplace's Equation
- 3.2 Uniqueness Theorem
- 3.3 Method of Images

PHYSICS 362 - Electricity and Magnetism

Sara Haravifard

- 3.4 Formal Solution to Poisson's Equation: Green Functions
- 3.5 Introduction to Separation of Variables
- 3.6 Separation of Variables in Cartesian Coordinates
- 3.7 Separation of Variables in Spherical Coordinates: General Theory
- 3.8 Separation of Variables in Spherical Coordinates with Azimuthal Symmetry
- 3.9 Separation of Variables in Spherical Coordinates without Azimuthal Symmetry
- 3.10 Multipole Expansions

Electrostatics in Matter

- 4.1 Polarizability and Polarization
- 4.2 The Electric Displacement Field
- 4.3 Linear Dielectrics
- 4.4 Boundary Value Problems with Linear Dielectrics
- 4.5 Electrostatic Energy in and Forces on Linear Dielectrics

Magnetostatics

- 5.1 Study Guidelines
- 5.2 Lorentz Forces and Current Densities
- 5.3 Conservation of Charge and the Continuity Equation
- 5.4 Fields of and Magnetic Forces between Currents
- 5.5 Curl and Divergence of the Magnetic Field; Ampere's Law
- 5.6 Magnetic Vector Potential
- 5.7 Boundary Conditions on Magnetic Field and Vector Potential
- 5.8 Magnetic Multipoles

Magnetostatics in Matter

- 6.1 Paramagnetism and Diamagnetism
- 6.2 The Field of a Magnetized Object
- 6.3 The Auxiliary Field H and Magnetic Permeability
- 6.4 Boundary Value Problems in Magnetostatics

Electrodynamics

- 7.1 Currents and Ohm's Law
- 7.2 Motional Electromotive Force
- 7.3 Electromagnetic Induction
- 7.4 Inductance
- 7.5 Magnetic Energy and Forces
- 7.6 Maxwell's Equations