Course Outline
Electromagnetic Theory
Physics 604

Meeting Times: 17:45-19:00, Tuesdays and Thursdays
Meeting Place: OCNPS 303
Text: J. D. Jackson, *Classical Electrodynamics,* 3rd Edition, John Wiley
Office Hours: 2:30-4:00 Thursdays OCNPS 213
Supplementary Texts: Landau and Lifshitz, *Classical Field Theory*, Greiner, *Classical Electrodynamics*, Flanders, *Differential Forms with Applications to the Physical Sciences*, Weintraub, *Differential Forms*
Grading: Homework Problems 20%; Mid-term Examination 30%; Final Examination 50%

Course Content

Introduction to Electromagnetism
Constitutive Relations

- Introduction to Electrostatics (Chapter 1)
  Coulomb's Law
  Gauss's Law
  Poisson and Laplace Equations
  Green's Theorem
  Electrostatic Energy
- Boundary-Value Problems in Electrostatics: I (Chapter 2)
  Method of Images
  Green Function for the Sphere
  Orthogonal Functions and Expansions
  Separation of Variables; Laplace Equation in Rectangular Coordinates
- Boundary-Value Problems in Electrostatics (Chapter 3)
  Laplace Equation in Spherical Coordinates
  Legendre Equation; Legendre Polynomials
  Associated Legendre Functions and Spherical Harmonics
  Addition Theorem
  Laplace Equation in Cylindrical Coordinates; Bessel Functions
- Multipoles, Electrostatics of Macroscopic Media, Dielectrics (Chapter 4)
  Multipole Expansion
  Multipole Expansion of the Energy of a Charge Distribution
  Boundary-Value Problems with Dielectrics
  Electric Polarizability
  Electrostatic Energy in Dielectric Media
- Magnetostatics, Faraday's law, Quasi-static Fields (Chapter 5)
  Biot Savart Law
  Vector Potential

Macroscopic Equations, Boundary Conditions on **B** and **H**
Uniformly Magnetized Sphere
Faraday's Law of Induction
Energy in the Magnetic Field