

Course Outline
Electromagnetic Theory
Physics 704/804

Meeting Times: 11:00-12:15, Tuesdays and Thursdays

Meeting Place: OCNPS 303

Text: J. D. Jackson, *Classical Electrodynamics*, 3rd Edition, John Wiley

Office Hours: 1:30-3:00 Thursdays OCNPS 213

Supplementary Texts: Landau and Lifshitz, *Classical Field Theory*, Flanders, *Differential Forms with Applications to the Physical Sciences*, Weintraub, *Differential Forms*

Grading: Homework Problems 40%; Mid-term Examination 20%; Final Examination 40%

Course Content

- Introduction to Differential Forms
 - Faraday's Law in Forms
 - Constitutive Relations
- Maxwell Equations (Chapter 6)
 - Displacement Current
 - Vector and Scalar Potential
 - Gauge Transformations
 - Wave Equation and Retarded Green Function
 - Energy Conservation and Poynting's Theorem
 - Transformation Properties of E-M Quantities
- Electromagnetic Waves (Chapter 7)
 - Plane Wave Solutions
 - Reflection and Refraction
 - Polarization
 - Total Internal Reflection
- Wave Guides and Cavities (Chapter 8)
 - Propagating Modes
 - Electromagnetic Cavities
 - Optical Fibers
- Radiating Systems and Multipoles (Chapter 9)
 - Dipole and Quadrupole Radiation
 - Spherical Waves
 - Angular Momentum
- Diffraction (Chapter 10)
 - Blue Sky
 - Optical Theorem
- Special Relativity (Chapter 11)
 - Relativistic Invariance and Lorentz Transformations

Lorentz Group

Thomas Precession; BMT Equation

Covariance of Electromagnetism

Transformation of Electromagnetic Fields

- Radiation by Accelerated Charges (chapter 14)

Lienard-Wiechert Potentials

Larmor's Formula; Angular Distribution of Radiation

Synchrotron Radiation

Undulator Radiation

Thomson Scattering