

PHYS 8201: Advanced Electromagnetic Theory I

Instructor: W. M. Dennis, Room 201

Text: *Classical Electrodynamics*, 3rd Ed., John D. Jackson, (Wiley, 1999).

Reference: *Modern Problems in Classical Electrodynamics*, Charles A. Brau, (Oxford, 2004).

Reference: *The Classical Theory of Fields*, 4th Revised English Ed., L. D. Landau and E. M. Lifshitz, (Elsevier, 1975).

Reference: *Electrodynamics of Continuous Media*, 2nd Ed., L. D. Landau, E. M. Lifshitz and L. P. Pitaevskii, (Elsevier, 2004).

Reference: *Classical Electricity and Magnetism*, 2nd Ed., Wolfgang K. H. Panofsky and Melba Phillips, (Dover, 2005).

Reference: *Introduction to Electrodynamics*, 3rd Ed., David J. Griffiths, (Prentice Hall, 1999).

Reference: *Introduction to Special Relativity*, Robert Resnick, (Wiley, 1968).

Reference: *Gravitation*, Charles W. Misner, Kip S. Thorne and John A. Wheeler, (Freeman, 1973).

Reference: *A Brief on Tensor Analysis*, 2nd Ed., J. G. Simmonds, (Springer Verlag, 1994).

Office Hours: Will arrange in class when you know your schedules.

Exams: Test I, Test II, Final (All Closed Book and Cumulative)

Excused Absences: An excused absence for any test will cause the final exam grade to be substituted for that test grade.

Homework: Will assign problems. Selected Problems will be graded.

Grade: Total Grade = (Homework + Test I + Test II + Final)/4

Grading Scheme: Use of the plus/minus system is a requirement – it is the only grading system approved for the University of Georgia.

	$A \equiv [85, 100]$	$A- \equiv [82.5, 85)$
$B+ \equiv [80, 82.5)$	$B \equiv [70, 80)$	$B- \equiv [67.5, 70)$
$C+ \equiv [65, 67.5)$	$C \equiv [55, 65)$	$C- \equiv [52.5, 55)$
$D \equiv [40, 52.5)$	$F \equiv [0, 40)$	

Topics:

1. Relativistic Kinematics
 - (a) The Principles of Special Relativity
 - (b) The Lorentz Transformation
 - (c) 4-Vectors and 4-Tensors
 - (d) Electromagnetic Fields
2. Relativistic Dynamics and Field Theory
 - (a) Relativistic Free Particle
 - (b) Charged Particle in a Vector Potential
 - (c) The Maxwell Equations
 - (d) Invariance and Conservation Laws
3. Selected Topics in Electrostatics and Magnetostatics
4. Macroscopic Materials
 - (a) Polarization and Magnetization
 - (b) Properties of Dielectric and Magnetic Materials
5. Electromagnetic Waves in Linear Dispersive Media
 - (a) Plane Waves
 - (b) Linear Media
 - (c) Reflection and Refraction at Surfaces
6. Radiating Systems
 - (a) Fields and Radiation of a Localized Oscillating Source
 - (b) Electric Dipole Fields and Radiation
 - (c) Center-Fed Linear Antenna
 - (d) Multipole Expansion of EM Fields
7. Scattering and Diffraction
 - (a) Scattering at Long Wavelengths
 - (b) Perturbation Theory
 - (c) Scattering by a Sphere
 - (d) Optical Theorem
8. Selected topics in Radiation by Relativistic Particles