PHYS 8201: Advanced Electromagnetic Theory I

Instructor: W. M. Dennis, Room 201


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.

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\begin{align*}
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]
\end{align*}
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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. Time Independent Electromagnetic Fields
   (a) Electrostatics
   (b) Boundary-Value Problems with Conductors
   (c) Magnetostatics

4. Electromagnetic Waves
   (a) Plane Waves
   (b) Canonical Equations of an Electromagnetic Field

5. Macroscopic Materials
   (a) Polarization and Magnetization
   (b) Properties of Dielectric and Magnetic Materials

6. Linear Dispersive Media
   (a) Linear Media
   (b) Reflection and Refraction at Surfaces

7. Radiation by Relativistic Particles
   (a) Angular and Spectral Distribution of Radiation
   (b) Bremsstrahlung and Transition Radiation
   (c) Thompson Scattering
   (d) Synchrotron and Undulator Radiation
   (e) Radiation by Relativistic Particles Traveling Through Matter