Phys 6103: Electromagnetism (2026)

August, 2026

Time: 11:00pm – 12:15pm, Mon/Wed
Location: Mason 3133

Instructor information:
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Office hour: Tue, 9am - 10am

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Course Text:
No textbook is required.
Lecture notes after each lecture will be updated on Canvas.
You can find the lecture notes on Canvas: Files → Lecture Notes.

The following textbooks are recommended as references. It is totally fine if you don't have any of these two books.

1. Andrew Zangwill, "Modern Electrodynamics"
2. J. David Jackson, "Classical Electrodynamics"

Description of Graded Components:
Reviewing class notes and working problems are crucial components in mastering difficult concepts and methods, and in preparing the quiz and final exam components of the graded work. You are welcome to discuss and brainstorm solutions to problems with your class mates, but please write up your own independent solutions. Substantially correct and complete solutions will be awarded full marks in grading. The quizzes and final examination (comprehensive) will involve solving problems and proving results, of a style like the assignments, with a length appropriate to the time constraints.

Course Requirements & **Grading**:
Homeworks: 55% (4 $\sim$ 5 HWs)
Quizzes: 20% (The best one out of 2, quizzes in class)
Final: 25% (Take home exam)

Grading Scale:
Your final grade will be assigned as a letter grade according to the following scale:

A: 90-100 %
B: 80-89 %
C: 70-79 %
D: 60-69 %
F: 0-59 %

(At Georgia Tech, grades are awarded on a scale of A-F with no +/- grades permitted. According to policy, grades at Georgia Tech are interpreted as follows:

A: Excellent (4 quality points per credit hour)
B: Good (3 quality points per credit hour)
C: Satisfactory (2 quality points per credit hour)
D: Passing (1 quality point per credit hour)
F: Failure (0 quality points per credit hour)

See `http://registrar.gatech.edu/info/grading-system` for more information about the grading system at Georgia Tech.)

Personal Support (Georgia Tech Resources):

1. The Office of the Dean of Students: `https://studentlife.gatech.edu/about/dean-students`.
2. Center for Mental Healthcare and Resources: `https:/mentalhealth.gatech.edu`.
3. Students' Temporary Assistance and Resources (STAR): `https://star.studentlife.gatech.edu`
4. Georgia Tech Police: 404-894-2500

Statement of Intent for Inclusivity:

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. Because we are individuals with varying needs, I am reliant on your feedback to achieve this goal. To that end, I invite you to enter into dialogue with me about the things I can stop, start, and continue doing to make my classroom an environment in which every student feels valued and can engage actively in our learning community.

Course Schedule:

As a very rough plan, we may cover the following topics. Again, it is totally fine if you do not have Zangwill's book.

1. **Properties of Maxwell equations**

   [Sec.2 and Sec.15 of Zangwill.]

2. **Electrostatics**

   – Quick introduction or reminder

   [Sec.3 of Zangwill]

   – Electric multipoles: Multipole Expansion, energy of multiples,

   [Sec.4.1-4.4 of Zangwill]

   – Laplace's and Poission's equation

   [Sec.7.1-7.4, 7.7; Sec.8.1-8.4 of Zangwill]

3. **Magnetostatics**

   – Biot and Savart law, Ampere's law, scalar potential and vector potential.

   [Sec.10.1-10.5 of Zangwill]

   – Magnetic moment: Static magnetic field. Vector potential in the Coulomb gauge. Magnetic fields of a localized current distribution. Relation between magnetic and mechanical moments.

   [Sec.11.1, 11.2 of Zangwill]

   – Simple magnetic matter: Magnetic moment in an external magnetic field (torque, force, potential energy). Larmor's theorem. Diamagnetism. Paramagnetism. Curie's law. Exchange interaction.

   [Sec.12.1, 12.2; Sec.13.1-13.6 of Zangwill]

4. **Dynamics and Quasistatic fields**

   Quasi-static approximation, Slowly time-varying charge/current in vacuum and in conductors, Skin effect.

   [Sec.14.5-14.7, 14.10 of Zangwill]

5. **Electromagnetic waves**

   – Waves in vacuum: Wave equation. Plane EM waves. Monochromatic waves. Helmholtz equation. Doppler effect. Elliptical, linear and circular polarization.

   [Sec.16.1-16.4, 16.6 in Zangwill]

   – Waves in simple matter: Waves in nondispersive media. Wave impedance. Index of refraction. Reflection and refraction: Snell's law, Fresnel equations, reflection and transmission coefficients, polarization by reflection, Brewster's angle, total internal reflection.

   [Sec.17.1-17.3 in Zangwill]

6. **Retardation and radiation**

   – Fields from moving charges: Green's functions for the wave equation. Lienard-Wiechert potentials and fields for a point charge. Point charge in uniform motion. Spectral decomposition of the retarded potentials.

   [Sec. 20.1-20.3, 23.1, 23.2 in Zangwill]

   – Multipole fields and radiation: Fields of a system of charges at large distances. Dipole radiation. Quadrupole and magnetic dipole radiation.

   [Sec.20.5, 20.7 in Zangwill]

7. **Scattering**

   Scattering cross section, Thomson scattering

   [Sec.21.1-21.3 in Zangwill]