

Course home page:

<https://www.physics.purdue.edu/fermion/courses.html>

Syllabus for E&M I

Physics 630 at Purdue University

From a long view of the history of mankind---seen from, say, ten thousand years from now---there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics. The American Civil War will pale into provincial insignificance in comparison with this important scientific event of the same decade.

by Richard P. Feynman, in The Feynman Lectures on Physics (1964), Vol. 2, page 1-11.

Instructor: Chris Greene, PHYS 280 chgreene__at__purdue.edu , phone ext: 6-1859,

Class lectures: Tuesday and Thursday, 9:00-10:15 am, **PHYS 201 (note room change!!)**

Grading rubric: Grades will be based on the combination of homework scores (30%), a midterm exam (30%) and a final exam (40%).

Office Hours: 1:30-2:30 pm, PHYS 280, Mondays and Wednesdays, or informally, or by appointment; also, feel free to email me at any time with questions

Midterm Exam: Will be held IN CLASS on Thursday, October 16. It will be closed book, but you will be allowed to bring a sheet of notes on a normal letter-sized piece of paper, 8.5" x 11", ONE SIDE ONLY. No computers nor phones nor calculators can be used during the exam.

Grader: Zhibo Ren (email: ren222_at_purdue.edu

→ office hours 2:30-3:30 on Thursdays in PHYS 309, or by appointment)

Required Text: J. D. Jackson, **Electrodynamics**, 3rd Edition

Recommended computational software: **Mathematica (allowed for homework, unless otherwise stated)**

Note that I view this as the first semester of a two-semester course, and I strongly recommend that you plan to also take the second semester, Physics 631, at some point.

Tentative list of topics for the fall 2025 semester of Physics 630:

- Maxwell's equations overview
- Review of relevant relations from vector calculus
- Green's functions, boundary conditions, partial differential equations
- electrostatics in vacuum and in dielectric media
- magnetostatics in vacuum and in magnetic media
- energy and momentum conservation and the stress tensor

- time-dependent fields
- electromagnetic waves in vacuum and in media

Tentative list of topics for the spring 2026 semester of Physics 631 (next page)

- Kramers-Kronig dispersion relations
- Electromagnetic waves in waveguides and cavities
- Radiation generated by oscillating charges and currents
- Scattering and diffraction of electromagnetic waves, Rayleigh scattering
- Special theory of relativity in electromagnetism
- The Thomas precession effect
- Relativistic Lagrangian dynamics of particles and fields
- Radiation by charged particles
- Energy loss of charged particles, Cherenkov radiation, etc. (time permitting)
- Radiation reaction and radiative damping