

Electricity and Magnetism

<u>Instructor:</u>	Lawrence Gibbons 318 Physical Sciences 607-255-9931	Office Hours: Mon, 2:15 - 3:45 PM or by appt. lkg5@cornell.edu (please include "3327" in subject)
<u>TA:</u>	Guglielmo Papiri 425C Physical Sciences	Office Hours: TBA gp343@cornell.edu
<u>Course structure:</u>	Lectures Recitation	MWF, 335 Baker Lab, 11:15 - 12:05 PM 201: Th, 103 Rockefeller, 10:10 - 11:00 AM 202: F, Clark 294C, 12:20 - 1:10 PM 203: F, 112 Rockefeller, 02:30 - 3:20 PM

Course goals:

- Explore advanced techniques in electrostatics
- Explore the dynamical aspect of Maxwell's equations and the role of the electromagnetic fields in conservation of energy and momentum
- Understand the origin of gauge transformations and their utility in E&M
- Understand plane waves as the building blocks for EM radiation and the frequency-dependent behavior of EM waves in a variety of materials and waveguides
- Gain exposure to mechanisms for the generation of EM waves
- Explore the relationship between Special Relativity and Maxwell's Equations

Homework: One set each week, released each Monday, due via Gradescope (accessible from Canvas) by 11 AM on the *Wednesday* of the following week. Please note that there will be the exceptions for Fall Break, Thanksgiving and the final problem set. Working together on the homework is encouraged, but the submitted work must be your own. The homework assignments teach you the material – I am your guide. You should expect to find the HW challenging.

Late homework: To submit late, you will need to [email me](#) to extend your Gradescope due date. You have 2 "free passes" to submit homework late, no questions asked, over the course of the semester. Typical extensions will be 2 days. Late homework will otherwise be subject to 2-point penalty for each calendar day late. If you know of a conflict or are ill, please contact me [in advance](#) and we will make a plan separate from the free passes. Otherwise late homework will be subject to the rules above.

Study Halls: There will be a regularly-scheduled Study Hall on Tuesdays from 4:00 PM to 10:00 PM in 301 PSB. Again note that Fall Break and after Thanksgiving will require exceptions. Details will be available on Canvas in our course calendar.

Required Text: M.A.Heald and J.B.Marion, *Classical Electromagnetic Radiation*, 3rd edition.

Helpful Reference:

- Griffiths, David, "Introduction to Electrodynamics, 3rd Ed.", Prentice-Hall, Inc., NJ, 1999

Exams: Tentatively, both prelim exams will be take-home, for which you will be allowed up to 6 hours (noncontiguous) to complete. Each exam will note the explicit time limit. Both texts, notes and Canvas information may be used, but no other resources, internet-based or otherwise. Unlike the HW, you may not collaborate with your classmates on the exams. Prelims will be due ~1 week after their release. The final, comprehensive, will be in-person.

- Tentative Prelim dates:

- release dates — Sept 24 and Nov 4 @ 1 PM
- due dates — Oct 1 and Nov 12 @ 4 PM
- Final exam: Our scheduled Final Exam date — TBA

Grades: prelims 2@19%, Final = 28%, HW = 30%, Polling Participation 4%.
• PollEv.com/phys3327

The lowest homework will be dropped. For some flavor of A grade, boundaries will likely be ~90 for an A-, 94-95 for an A, and 98-99 for an A+, depending on where natural gaps appear. I recommend doing ALL the homework to maximize your chance for your highest possible grade, rather than using the dropped HW as an invitation to skip one of the assignments.

Ed Discussion: Course material and HW discussions will occur over *Ed Discussion*, linked from our canvas site. The primary use is for all of you to discuss the material. Our TA, Guglielmo, will primarily monitor the site for questions. If you have a direct question about the course material that you would like me to answer, please [email me](#).

Conflicts: I recognize that you can have conflicts or unexpected situations (illnesses, etc.) that can make attendance, or HW deadlines, or exam dates occasionally problematic. *When you contact me in advance of the relevant deadline, you will find me very accommodating.* After the fact notifications will be considered in the context of whether advanced notification was possible.

Conduct: Please abide by:

- [Cornell Code of Academic Integrity](#): As a scientist, you will find that scientific integrity is valued highly. Abuse can destroy one's career. The principles overlap strongly with those laid out in the Cornell Code.

Week 1: 8/25, 8/27, 8/29	M&H Ch 1	Intro + statics review, boundary conditions
Week 2: 9/1 no classes, 9/3, 9/5	M&H Ch 2	Multipole expansions
Week 3: 9/8, 9/10, 9/12 (add/drop ends 9/8)	M&H Ch 2, 3	Multipole expansion, Boundary value problems and Laplace's eqn, Sep. of Variables in Cartesian coord's
Week 4: 9/15, 9/17, 9/19	M&H Ch 3	Sep. of Variables in Spherical, Cylindrical coord's
Week 5: 9/22, 9/24, 9/26 (prelim 1 released)	M&H Ch 4	Dynamics: chg. conservation, Poynting Vec, Energy, Stress Tensor
Week 6: 9/29, 10/1, 10/3 (prelim 1 due)	M&H Ch 5	Gauge transformation, plane waves, polarization, power
Week 7: 10/6, 10/8, 10/10	M&H Ch5, 10..3, 10.5	Dispersion, waves in conductors, phase vs group velocity, generalized dielectric (freq. dependent)
Week 8: (10/13 Fall break), 10/15, 10/17	M&H Ch 6	phase vs group velocity, generalized dielectric (freq. dependent)
Week 9: 10/20, 10/22, 10/24 (10/20 last day to drop classes)	M&H Ch 7	Reflection + transmission at boundaries, Waveguides
Week 10: 10/27, 10/29, 10/31	M&H Ch 8	Waveguides, Retarded potentials
Week 11: 11/3, 11/5, 11/7 (prelim 2 released)	M&H Ch 9	Radiation fields, Generation of radiation
Week 12: 11/10, 11/12, 11/14 (prelim 2 due)	M&H Ch 9	Generation of radiation
Week 13: 11/17, 11/19, 11/21	M&H Ch 10	Generation of radiation, Special relativity
Week 14: 11/24, (Thanksgiving: 11/26, 11/28)	M&H Ch 10	Special relativity. Griffith's text will be especially helpful for this final unit
Week 15: 12/1, 12/3, 12/5	M&H Ch 10	Special relativity
Week 16: 12/8		Review session