PHYSICS 350 – ELECTRICITY AND MAGNETISM

Fall Semester 2015 TR 10:30–11:45 WAT 113

Instructor: Eric B. Szarmes (szarmes@hawaii.edu)
Office: Watanabe Hall, Room 212
Office hours (tentative): 12:00–1:00 MWF, Watanabe Hall, Room 421

Course Description: Electrodynamics occupies a unique position in the physics curriculum. Of the four fundamental forces, it alone governs – together with the principles of quantum mechanics – *all* of the local physical interactions of everyday life. It also presents students with their first example of a fully developed and self-consistent field theory. This course develops the fundamentals of classical electrodynamics as embodied in Maxwell's equations, the Lorentz force law, and the constitutive relations describing static and time-varying electric and magnetic fields in vacuum and in matter. The treatment also develops and utilizes the mathematical tools of vector differential and integral calculus, special functions, and the techniques of mathematical physics. The course is designed to emphasize the rich mathematical and physical content of the electromagnetic field, and to provide a solid foundation for advanced study at the post-graduate level.

Textbook: David J. Griffiths, *Introduction to Electrodynamics, 4th ed.,* Pearson Higher Ed., Boston, 2013

Course website: https://laulima.hawaii.edu → PHYS-350-001 [MAN.72296.FA15] → Resources

Grade distribution:

Weekly assignments:	10%
Midterm examinations 1 and 2:	25%/25%
Final examination:	40%

Grade assignment *(approximate)*:

A+	90 >	B+	75–80	C+	60–65	C–	40–50
A	80–90	B	65–75	C	50–60	D/F	< 40

COURSE OUTLINE

Dates	Topics	Chapter
8/25–9/8	introduction; status of electrodynamics; review of vector analysis; vector differential calculus; vector integral calculus; the Dirac delta function	1
9/10–9/24	electrostatics; the electric field **E**; Coulomb's law; divergence and curl of electrostatic fields; electric potential; work and energy in electrostatics; properties of conductors	2
October 1	*Midterm Examination #1*	
9/29–10/13	Laplace's equation; boundary conditions and uniqueness theorems; method of images; separation of variables; multipole expansion; monopoles and dipoles	3
10/15–10/27	electric fields in matter; polarization; dielectrics and induced dipoles; field of polarized objects; the electric displacement **D**; linear and nonlinear dielectrics; permittivity	4
November 5	*Midterm Examination #2*	
10/29–11/12	the magnetic field **B;** magnetostatics; the Lorentz force law; forces and currents; the Biot-Savart law; vector properties; Ampere's law; magnetic vector potential	5
11/17–11/19	magnetic fields in matter; magnetization; torques and forces on magnetic dipoles; the auxiliary field **H**; magnetic media; permeability	6
11/24–12/8	the electromotive force; electromagnetic induction; Faraday's law; Maxwell's correction to Ampere's law; Maxwell's equations in vacuum and in matter	7
12/10	review	
Dec. 14–18	*Final Examination*	