Classical Electrodynamics II

Tuesday, Thursday 12:30 to 2:30, BPS 1300

August 26 to October 13

Prerequisite: Classical Electrodynamics 1: Electromagnetic field in free space.

Instructor: Mark Dykman, BPS 4244, e-mail: dykmanm@msu.edu

Office hours: Monday 2:00 – 4:00 pm and by appointment

Recommended Textbooks: L.D. Landau and E.M. Lifshitz, *Electrodynamics of Continuous Media*, 2nd edition (Elsevier Butterworth-Heinemann, Oxford 2004).
J.D. Jackson, *Classical Electrodynamics*, 3rd edition (Wiley, NY 1999).
Steven M. Girvin and Kun Yang, *Modern Condensed Matter Physics*
(Cambridge University Press 2019)

Homework assignments will be given on Tuesdays and are due a week from the day they are given. I encourage you to try to solve the problems rather than to look up the solutions

Pizza presentations at the end of the class: 15 to 25 min blackboard presentations. Topics will be provided in advance. Time and place to be discussed.

Tentative Schedule

Date	Topic
Aug. 27 – Sep. 3	Electrostatics of conductors: macroscopic vs microscopic electric field and its energy, mutual capacitance, methods of images and virtual displacements, force on a conductor
Sep. 5 – 12	Electrostatics of dielectrics: polarization, dielectric constant and its sign, dielectric sphere in a field, total free energy, dielectric properties of crystals
Sep. 17	Conductivity. Micro- and macroscopic current, the Einstein relation, contact potential
Sep. 19 – 26	Static magnetic field: Magnetic fields, magnetic susceptibility, surface current, free energy of magnetics, self-inductance and mutual induction

Tentative Schedule (continued)

Date	Topic
Oct. 1	Ferromagnetism: magnetic anisotropy, hysteresis
Oct. 3 – 8	Superconductivity: Landau-Ginzburg equation, flux through a ring, SQUIDs
Oct. 10	Maxwell's equations for macroscopic fields frequency-dependent dielectric constant, absorption and refraction, energy of the electromagnetic field.