Oberlin College Physics 111, Spring 2024

Assignment 10

Monday, 15 April

Reading: LSM chapter 16, "Electromagnetic Waves". Read to a greater or lesser extent, depending upon your interest.

Laboratory: "AC Circuits I".

Problems: There are *no* assigned problems this week. Instead, there will be an exam on Wednesday, 24 April. Be sure to look at the sample exam overpage.

Guest lectures: Oberlin College honors students will be giving presentations in the upcoming week (in Wright 201 at 4:35 pm). The usual extra credit rule applies.

Shuran Zhu: Tuesday, 23 April, "An Airy Problem: Quantal Time Evolution with Constant Force". (Hand in description on Friday, 26 April.)

Iago Braz Mendes: Thursday, 25 April, "Isometric Embeddings of Black Holes: Numerical Horizons in Euclidean Space.". (Yes! This is the same Iago as our HOOT. Hand in description on Friday, 26 April.)

HOOT session: To accommodate Shuran Zhu's talk, the Tuesday HOOT session, normally running from 5:00 pm to 7:00 pm, will commence when the talk ends, but still end at 7:00 pm.

Exam: On Wednesday, 24 April. You may use a calculator (the one in your phone is fine) and one $8\frac{1}{2}$ by 11 inch page of notes, but not your lab notebook, lab instructions, or any other material. No collaboration is permitted. Exam topics are:

Current
DC circuits; RC circuits (lab and lecture)
Electrical safety, shielding, grounding
Using an oscilloscope
Feeling magnetic field ($q\vec{v} \times \vec{B}$)
Making magnetic field (Biot-Savart law, Ampere's law)
Solar cells
Laboratory measurement of magnetic field
Induced electric field, Faraday's law, inductance, LR circuits

There will be no exam questions concerning:

LC circuits or AC circuits

Sample exam: In order to give you an idea of what to expect, here is a sample exam made up of exam problems I've given previously. (Although this sample has five problems, the real exam will have four.)

- 27: *Wire resistance*
  [*Answer:* 89.3 m. Note that there's no need to convert wire diameter measurements from inches into meters, nor to use radius instead of diameter. The 18 gauge wire has twice the diameter, hence four times the cross-sectional area.]
- 34: *A circuit with five resistors and two batteries*
- 42: $\vec{E}$ *and* $\vec{B}$ *together*, parts (a) and (b) only.
  [*Answers:* (a) east; (b) $v = E/B$.]
- 46: *Magnetic forces on wires*

  [*Answers:* (a.) $\dfrac{\mu_0 i}{\sqrt{2}\pi a}$ northeast (b.) $\dfrac{\mu_0 i^2 L}{\sqrt{2}\pi a}$ southeast.]
- 55: *Change of frequency*
  [*Answer:* 19 mV.]