Learning Objectives 1.1 and 1.2: I can articulate what I will learn and how I will be assessed in this course. I can articulate practical applications of electromagnetics.

Show your work. Write a **Documentation** line at the end (**None** if you did not collaborate). Use $c = 3 \times 10^8$ m/s.

1. **Wavelengths across the spectrum.**

   (a) Find the free-space wavelength of the 60 Hz power grid, the GPS L1 signal at 1575.42 MHz, and an X-band radar at 10 GHz.

   $\lambda_{60\text{ Hz}}$ =

   λ_{GPS} =

   λ_{X} =

   (b) A 1 m connection carries each of the three signals. For which of them is the connection a significant fraction of a wavelength? Explain in one or two sentences why that matters.

   (c) Name one Air Force system that uses electromagnetic waves, and state one question about it that this course will help you answer.

2. **The course, and where circuit theory comes from.**

   (a) How is each learning objective assessed, and what can you do if you earn a 0 on an assessment?

   (b) A transformer steps 120 V down to 12 V. Which of Maxwell's equations explains how it works? Explain in one sentence.

   (c) Faraday's law in integral form is $\oint_C \vec{E} \cdot d\vec{\ell} = -\dfrac{d}{dt} \int_S \vec{B} \cdot d\vec{s}$. Explain how it reduces to Kirchhoff's voltage law, and under what condition.

   (d) Kirchhoff's current law follows from conservation of charge. State the condition under which it holds, and give one situation in this course where it does not.

Documentation: _____