Physics 272. Midterm III

Please write your name at the top of the page. There are 4 problems. Each is assigned 25 points. Show your work.

Problem 1: 25 points

A 80-turn coil has a radius of 5.0 cm and a resistance of 30 Ω. At what **rate** must a perpendicular magnetic field change to produce a current of 4.0 A in the coil ?

Problem 2: 25 points

In the circuit below, the ac generator produces an rms voltage of 115 V when operated at 60 Hz.

(a) What is the rms current in the circuit ?

(b) What is the rms voltage between B and C ?

(c) What is the rms voltage between C and D ?

(d) What is the phase difference between the voltages across the resistor and the inductor ?

Problem 3: 25 points

An electromagnetic wave has a frequency of 100 MHz and is traveling in a vacuum. The magnetic field is given by $\vec{B}(z,t) = (10^{-8}\text{T})\cos(kz - \omega t)\hat{i}$

(a) Find the wavelength and direction of propogation of this wave.

(b) Find the direction and magnitude of the $\vec{E}$ field.

(c) Find the intensity of the wave.

Problem 4: 25 points

(a) What is the **frequency** of a 300 nm photon ? Would such a photon be visible to the human eye ?

(b) If the current through an inductor were doubled, how would the **energy stored in the inductor** and the **magnetic energy density in the inductor** change ?

(c) A parallel plate capacitor has two closely spaced plates. Charge is flowing onto the positive plate and off of the negative plate at a rate $dQ/dt = 3.0$A. What is the **displacement current** between the plates ? What is the **conduction current** between the plates ?

(d) You are stranded in outer space outside your space ship, but you happen to have a 1 kW laser with you. *Explain how you can get back to your space ship* ?

(e) The figure shows an ac generator. Give a short explanation of *how it works*.