

Physics 122
Midterm Examination #1
March 21, 2007

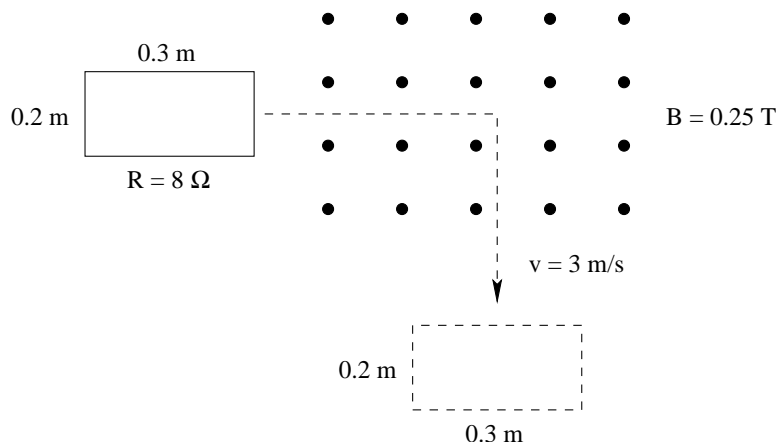
Name: _____

Recitation Section: _____

Lab Section: _____

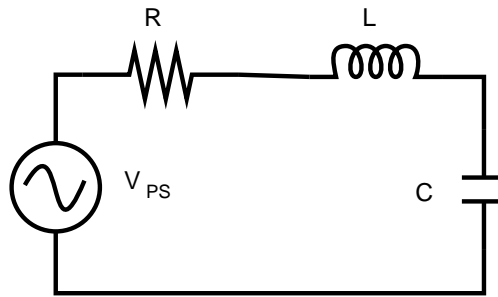
	Score
Problem 1	
Problem 2	
Problem 3	
Problem 4	
Problem 5	
Total	

1. Shown in the figure below is a rectangular loop located to the left of a region with a magnetic field ($B = 0.25 \text{ Tesla}$) pointed out of the paper. The loop is dragged with a constant speed of $v = 3 \frac{\text{m}}{\text{s}}$ along the path shown by the dashed arrow. The resistance of the loop is $R = 8 \Omega$.



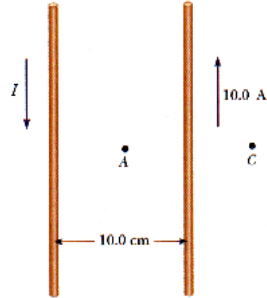
- (a) Determine the magnitude **AND** direction (clockwise or counter-clockwise) of the current in the loop during each of the following three conditions:
- The loop is entering the field region.
 - The loop is completely inside the field region.
 - The loop is leaving the field region.
- (b) Determine the magnitude **AND** direction of the force on the loop as it is exiting the field. Indicate the direction of the force by circling one of the following:
- Toward the left of the page.
 - Toward the top of the page.
 - Toward the right of the page.
 - Toward the bottom of the page.
 - Out of the page.
 - Into the page.

2. Shown below is an LRC circuit.



- Draw a phaser diagram representing this circuit.
- Analyze your phaser diagram to determine the magnitude of the impedance, $|Z|$.
- Analyze your phaser diagram to determine the phase of the impedance, ϕ_Z .
- Let the resistance be $R = 600 \Omega$, the inductance be $L = 1.04 \mu H$ and the capacitance be $C = 3 \times 10^{-12} F$. Determine the peak voltage across the resistor if the circuit is driven by an AC power source with $V_{peak} = 10 V$ and $f = 500 MHz$.
- Clearly, your circuit is not tuned for the $f = 500 MHz$ signal. Determine the frequency that your circuit **IS** tuned for.
- EXTRA CREDIT (1 point):** What are the call letters of this radio station?

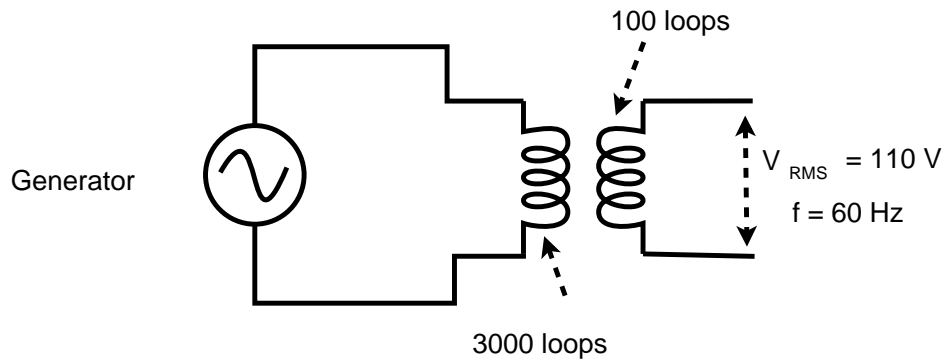
3. Two parallel conductors carry currents in opposite directions, as shown in the Figure below. One conductor carries a current of 10.0 A . Point A is the midpoint between the wires, and point C is 5.00 cm to the right of the 10.0 A current. I is adjusted so that the magnetic field at C is zero.



- (a) Find the value of the current I .
(b) Find the value of the magnetic field at A.

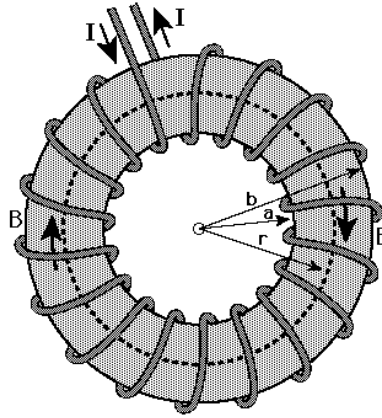
4. The circuit below shows a generator driving a transformer. The output side of the transformer has an AC voltage whose RMS is $V_{RMS} = 110\text{ V}$ and whose frequency is $f = 60\text{ Hz}$.

The generator is made from a circular coil of wire with $N = 400\text{ turns}$ whose radius is $r = 0.2\text{ m}$. The coil is rotated in a uniform magnetic field, B .



- (a) Determine the *peak* voltage applied to the input side of the transformer.
- (b) Determine the magnetic field in the generator.

5. Shown in the figure below is a toroid. The toroid carries a current I and has a total of N turns. Use Ampere's Law to calculate the magnetic field at the radius r shown in the Figure.



HINT: Think of a toroid as a long solenoid bent into a circular shape.