PHYS 2102

Exam 3

Spring 2000

Dr. Aktash

Name :_____

SS # : _____

You have five questions: 20 points each.

This is a closed book exam. I understand I am not to use any notes or information other than on this exam sheet. I may use a pocket calculator but only for the purpose of numerical calculation. I accept the responsibility to know and observe the requirements of the UNC-Charlotte Code of Student Academic Integrity.

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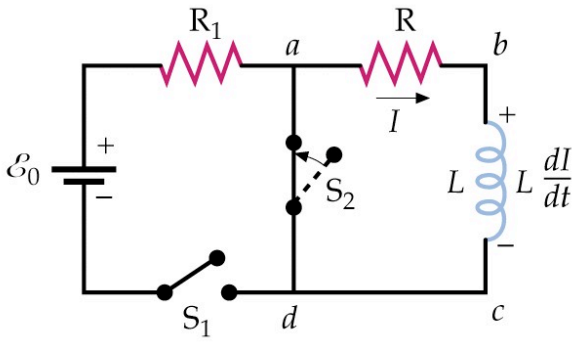
Signature

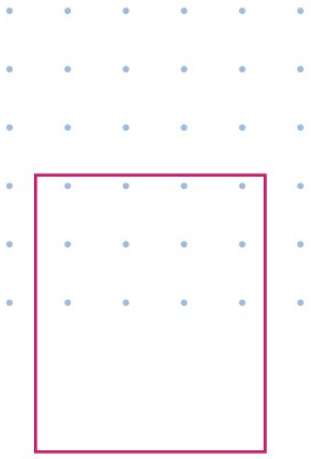
Good luck

Show all of your work. Do not skip steps. First write down the relevant equations then substitute the numbers if necessary.

1. An inductance L and resistance R are connected in series with a battery as in Figure below. A long time after switch S_1 is closed, the current is 2.5 A. When the battery is switched out of the circuit by opening switch S_1 and closing S_2, the current drops to 1.5 A in 45 ms. (a) What is the time constant for this circuit? (b) If R = 0.4 Ω, what is L?



2. The rectangular coil in Figure below has 80 turns, is 25 cm wide and 30 cm long, and is located in a magnetic field B = 1.4 T directed out of the page as shown, with only half of the coil in the region of the magnetic field. The resistance of the coil is 24 Ω. Find the magnitude and direction of the induced current if the coil is moved with a speed of 2 m/s (a) to the right, (b) up, (c) to the left, and (d) down.



3. A particle has a displacement $x = 0.4 \cos(3t + \pi/4)$, where x is in meters and t is in seconds. (a) Find the frequency f and period T of the motion. (b) Where is the particle at $t = 0$? (c) Where is the particle at $t = 0.5$ s? (d) Find an expression for the velocity of the particle whose position is given above (e) What is the velocity at time $t = 0$? (f) What is the maximum velocity? (g) At what time after $t = 0$ does this maximum velocity first occur?

4. A harmonic wave moves down a string with speed 12.4 m/s. A particle on the string has a maximum displacement of 4.5 cm and a maximum speed of 9.4 m/s. Find (a) the wavelength of the wave, and (b) the frequency. (c) Write an equation for the wave function.

5. A standing wave on a rope is represented by the following wave function:
$y(x, t) = 0.02 \sin(\pi x/2) \cos(40\pi t)$,where x and y are in meters and t is in seconds. (a) Write wave functions for two traveling waves that when superimposed will produce the resultant standing-wave pattern. (b) What is the distance between the nodes of the standing wave? (c) What is the velocity of a segment of the rope at x = 1 m? (d) What is the acceleration of a segment of the rope at x = 1 m?