PHYS 2102
Exam 2
Fall 2002- 01
Dr. Aktas

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

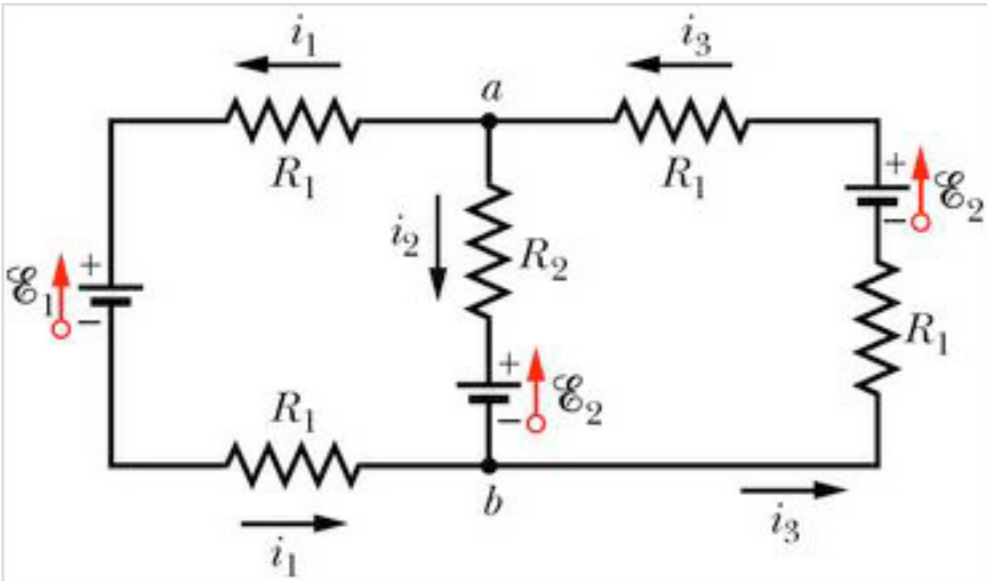
Show all of your work. Do not skip steps. First write down the relevant equations then substitute the numbers if necessary.

1. The current density across a cylindrical conductor of radius R varies in magnitude according to the equation $J = J_0 r/R$ where r is the distance from the central axis. Thus, the current density is a maximum J_0 at the cylinder's surface and decreases linearly to zero at the axis. Calculate the current in terms of J_0 and the conductor's cross-sectional area $A = \pi R^2$.

2. below shows a circuit whose elements have the following values:

$\mathscr{E}_1 = 3.0\ \text{V}, \mathscr{E}_2 = 6.0\ \text{V}, R_1 = 2.0\Omega, R_2 = 4.0\Omega.$

The three batteries are ideal batteries. Find the magnitude and direction of the current in each of the three branches.

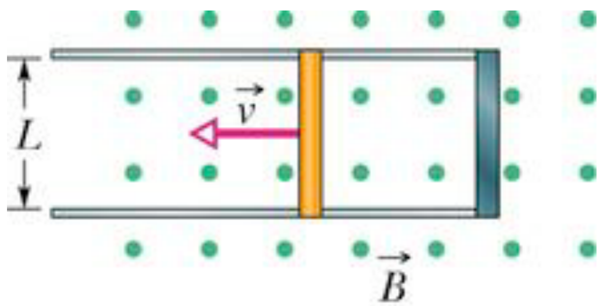


3. Figure below shows a rectangular 20-turn coil of wire, of dimensions 10 cm by 5.0 cm. It carries a current of 0.10 A and is hinged along one long side. It is mounted in the xy plane, at 30° to the direction of a uniform magnetic field of magnitude 0.50 T. Find the magnitude and direction of the torque acting on the coil about the hinge line.

4. In Fig. below , a straight wire of length L carries current i. Show that the magnitude of the magnetic field $\vec{B}$ produced by this segment at P_1, a distance R from the segment along a perpendicular bisector, is

$$B = \frac{\mu_0 i}{2\pi R} \frac{L}{\left(L^2 + 4R^2\right)^{1/2}}.$$

5. The conducting rod shown in Fig. 31-46 has length L and is being pulled along horizontal, frictionless conducting rails at a constant velocity . The rails are connected at one end with a metal strip. A uniform magnetic field , directed out of the page, fills the region in which the rod moves. Assume that L = 10 cm, v = 5.0 m/s, and B = 1.2 T. (a) What are the magnitude and direction of the emf induced in the rod? (b) What is the current in the conducting loop? Assume that the resistance of the rod is 0.40 W and that the resistance of the rails and metal strip is negligibly small. (c) At what rate is thermal energy being generated in the rod?



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