NAME

Please explain your answers in detail. What you write is all I have to grade the problem. Little credit will be given if your explanations involves generic phrases (such as "use Hamiltons principle") without a detailed explanation.

1. (a) What aspects of Faraday's law are demonstrated in the applet where the bar magnet moves through a conducting wire loop? (b) What is wrong with the solution posted on the wiki to this problem (homework 12 problem 4)?

2. On the part of the wiki devoted to this exam, there is a snapshot sketch of a plane harmonic electromagnetic wave. Apply the integral form of Ampere's law for this configuration of electric and magnetic fields. That is, choose an appropriate rectangular Amperian path whose width, given by ϵ, is very small. Then assume that the field for the line integral can be approximated by $B(x_2) \approx B(x_1) + (\partial B/\partial x)\triangle x$ where $B(x_2)$ and $B(x_1)$ are the fields at x_1 and $x_2 = x_1 + \epsilon$. Derive an partial differential equation in terms of how B_z changes with x and how E_y changes with t. Note that the Amperian path remains fixed in the coordinate system drawn while the wave moves through it along the x axis.

3. I have a channel of weakly conducting material (a solid rectangular "pipe" which is very long). Outline how you would solve for the current density inside this material if I put 4 electrodes isolated from each other on each side of this material with 12 V on one electrode and ground all the other sides (see figure on wiki). Assume magnetostatics and constant σ.

4. A bar magnet is moving at constant speed in free space toward a conducting wire loop. Explain how energy is conserved as it moves through the conducting wire loop and how you calculate it.

5. Watch the two video's whose links are found on the part of the wiki devoted to this exam or search youtube for "Dr. Pepper Meets Induction Heater" and "Red-hot ice cube by induction heating." Explain the physical mechanism shown in each video.