# Fundamentals of Electromagnetic Fields and Waves: I

Fall 2006, EE 30348, Electrical Engineering, University of Notre Dame

## Diagnosis: Assignment 3

The following points highlight some difficulties students had in the second assignment. Some advice on how to attack problems is also given.

1. When you use Gauss's law for the electric field in the integral form ($\oint_S \epsilon_E \mathbf{E} \cdot d\mathbf{S} = \int_v \rho_v(\mathbf{r}) dv$), and the volume charge density $\rho_v(\mathbf{r})$ is *not uniform*, you cannot multiply the charge density by the total volume, but have to actually evaluate the volume integral to find the total charge. However, if you know that the volume charge density *is uniform*, you are still evaluating the volume integral, but the charge density is constant, and you can pull it out - $\int_v \rho_v(\mathbf{r}) dv = \rho_v \int_v dv = \rho_v V$. Though this is a simple concept, some of you had difficulty in identifying when to do what.

2. Please read Page 67 from the textbook to get a better feel for what Lenz's law states - seems some of you have misconceptions about what the law states.

3. Read section 1.9 from the textbook to clarify the concept of a displacement current, and how its origin lies in a time-varying electric field. Now that we have also studied the differential form of Maxwell's equations, you have seen that the concept of displacement current is *necessary* for satisfying charge continuity at any point in space.