Notre Dame University
Faculty of Natural and Applied Sciences
Department of Sciences
PHS 212: Electricity and Magnetism
Test#2 Summer 2004, Duration: *60 minutes*
Instructor: M. El Tahchi, PhD

Student Name _____.   Date _____.
ID# _____.   **OPEN BOOK**

Problem I (35 pts)

The charge configuration of Figure 1 can be viewed as the sum of a point charge and a dipole. For point P on the axis of the three charges, with $r \gg d$, show that the electric potential $V(r)$ is given by:

$$V(r) = \frac{1}{4\pi\varepsilon_o} \frac{q}{r}\left(1 + \frac{2d}{r}\right)$$

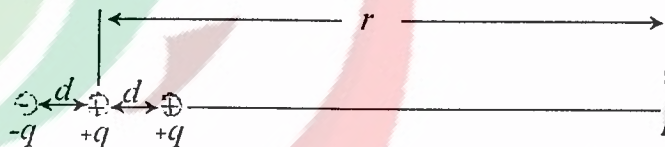Given that: $\dfrac{1}{x \pm x_0} \approx \dfrac{1}{x} \mp \dfrac{x_o}{x^2}$ for x much larger than x_o.

Figure 1

Problem II (15 pts)

What is the common way to beef up a capacitor? Explain.

Problem III (35 pts)

A coaxial cable consists of a copper wire, radius a, surrounded by a concentric copper thin tube of inner radius c. the space between is partially filled (from b out to c as shown in Figure 2) with material of dielectric constant ε_r. Find the capacitance per unit length of this cable.
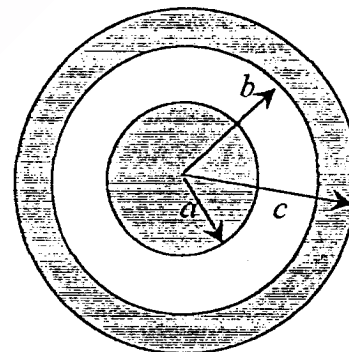

Figure 2

Problem IV (15 pts)

When a neutral dielectric is polarized, charges moves a bit creating bound charges. Prove that the total charge of the dielectric remains zero.