

## Electromagnetics I 1st exam. (Prof. Seong-cheol, Kim)

12th Apr 2008, AM 10:00 ~ 12:00

1. (20pt) Determine the capacitance per unit length between two long, parallel, circular conducting wires of radius  $a$ . The axes of the wires are separated by a distance  $D$ . ( Hint : assuming  $D \gg a$  )

2. (40pt) A metal sphere of radius  $a$  has a uniform surface charge distribution  $\rho_s$ . The permittivity of the surrounding region varies as  $\epsilon = \epsilon_0(1 + a/r)$ .

Find (a)  $\bar{D}, \bar{E}$  and  $\bar{P}$  everywhere in space, (b) the bound charge densities, and (c) the energy density, and (d) show that the potential in the dielectric region.

3. (20pt) show that the magnitude of the electric field intensity of an electric dipole is  $E = \frac{P}{4\pi\epsilon_0 r^3} [1 + 3\cos^2 \theta]^{1/2}$

4. (20pt) The conductors of an isolated two-wire transmission line, each of radius  $b$ , are spaced at a distance  $D$  apart. Assuming  $D \gg b$  and a voltage  $V_0$  between the lines, find the force per unit length on the lines.