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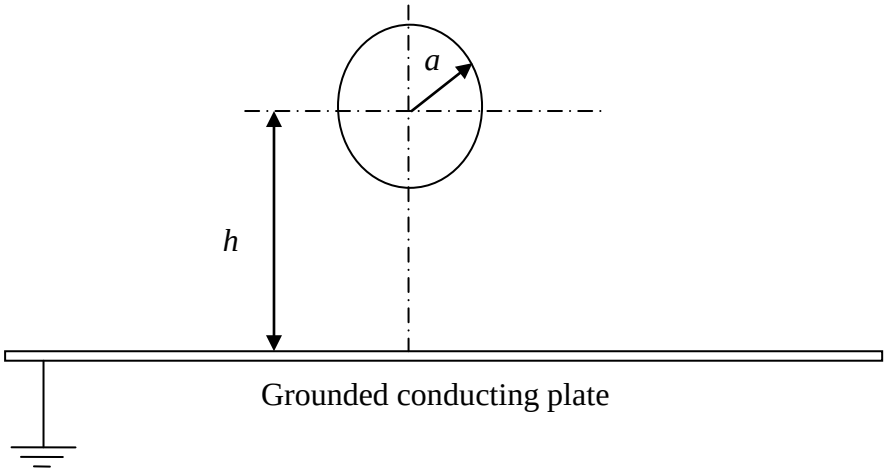
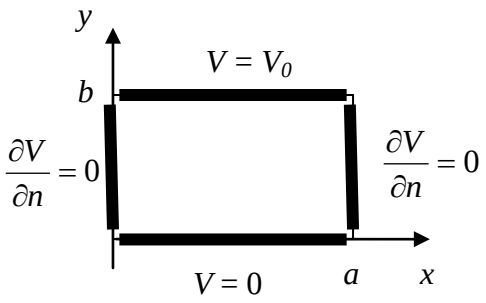
EE214000 Electromagnetics, Fall 2012
Homework Assignment # 5 (credit points: 100)
Due in class Dec.5, 2012

1. (15 points) Refer to EXAMPLE 4-10 of your textbook, calculate the electric potential and electric field outside an infinitely conducting cylinder of radius *b* in a uniform electric field of $\vec{E} = -E_0 \hat{a}_x$. The axis of the conducting cylinder is along *z*. Determine the ratio of the electric field at z = 0 and ϕ = 0 to E_0. (5 points)
2. (20 points) Assume that the space between the inner and outer conductors of a long coaxial cylindrical structure is filled with an electron cloud having a volume density of charge ρ = A*r*, for $a < r < b$, where *a* and *b* are the radii of the inner and outer conductors, respectively. The inner conductor is maintained at a potential V_0 and the outer conductor is grounded. Determine the potential (10 points) and electric-field (10 points) distributions in the region $a < r < b$ by solving Poisson's equation.
3. (25 points) A straight conducting wire of radius *a* is at a height of *h* above an infinitely large grounded conducting plate, as shown below. Find (1) the capacitance (10 points) and (2) the force per unit length (5 points) between the wire and the conducting plate. (3) Calculate the surface charge density induced on the conducting plate. (10 points) To calculate the force and the surface charge, assume the conducting wire carries a line charge of ρ_l.



4. (10 points) Refer to Fig. 4-10. Find the capacitance per unit length of the transmission line. Also, calculate the force per unit length, given an equal and opposite line charges of magnitude ρ_l on the wire and the tunnel.

5. (10 points) Find the electric potential in the following confined region.



6. (20 points) Problem 5-1 in DK Cheng's textbook.