VE230: Electromagnetics I
Homework V
Due: July 3, 11.59pm

P.5-6 Lightning strikes a lossy dielectric sphere—$\epsilon = 1.2\epsilon_0$, $\sigma = 10$ (S/m)—of radius 0.1 (m) at time $t = 0$, depositing uniformly in the sphere a total charge 1 (mC). Determine, for all t,

a) the electric field intensity both inside and outside the sphere,

b) the current density in the sphere.

P.5-8 A d-c voltage of 6 (V) applied to the ends of 1 (km) of a conducting wire of 0.5 (mm) radius results in a current of 1/6 (A). Find

a) the conductivity of the wire,

b) the electric field intensity in the wire,

c) the power dissipated in the wire,

d) the electron drift velocity, assuming electron mobility in the wire to be 1.4×10^{-3} $(m^2/V\cdot s)$

P.5-10 The space between two parallel conducting plates each having an area S is filled with an inhomogeneous ohmic medium whose conductivity varies linearly from σ_1 at one plate $(y = 0)$ to σ_2 at the other plate $(y = d)$. A d-c voltage V_0 is applied across the plates as in Fig.5-11. Determine

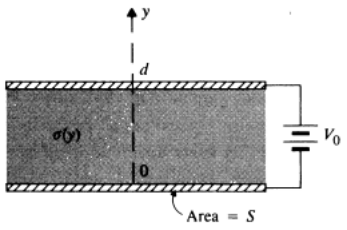

FIGURE 5–11
Inhomogeneous ohmic medium with conductivity $\sigma(y)$ (Problem P.5–10).

a) the total resistance between the plates,

b) the surface charge densities on the plates,

c) the volume charge density and the total amount of charge between the plates.

P.5-22 Assume a rectangular conducting sheet of conductivity σ, width a, and height b. A potential difference V_0 is applied to the side edges, as shown in Fig.5-14. Find

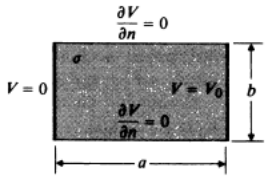

FIGURE 5–14
A conducting sheet (Problem P.5–22).

a) the potential distribution,

b) the current density everywhere within the sheet. (*Hint:* Solve Laplace's equation in Cartesian coordinates subject to appropriate boundary conditions.)