Homework 10
EE 381 Electric & Magnetic Fields (Fall 2024)
Wednesday, November 6, 2024

1) 5.5
2) 5.10 Also, find resistance R_{wire}. In addition, if the wire is along the z-axis with the higher potential at the top, find the electric field $\overline{E}_{\text{wire}}$ and current density $\overline{J}_{\text{wire}}$ in the wire.
3) 5.21 Also, determine χ_e, ρ_v, and $\overline{D}$ at this location.
4) 5.24 Hint: Gauss' Law
5) 5.29
6) Find the relaxation time for the following materials: a) mica, b) porcelain, c) distilled water, and d) Dead Sea water ($\sigma = 8$ S/m, $\varepsilon_r = 79$).
7) 5.47 Also, determine $\overline{D}$ and $\overline{P}$. Assume the media adjacent to the conducting surface is: a) free space and b) distilled water.
8) A dielectric interface is defined by $2x + 4y = 8$ m. Region 1, which includes the origin, has a relative permittivity of $\varepsilon_{r1} = 6$ (glass) and an electric field $\overline{E}_1 = 1600\hat{a}_x - 1200\hat{a}_y + 2000\hat{a}_z$ V/m. Region 2 is air ($\varepsilon_{r2} = 1$). Draw side view (x-y plane) picture. Then, find: a) unit vectors $\hat{a}_{n,12}$ and $\hat{a}_{n,21}$ normal the interface, b) electric flux density and polarization vectors in Region 1, c) electric field, electric flux density, & polarization vectors in Region 2, and d) energy density in each region.

Hints:

- See Appendix B for material properties if they are not given in the problem.
- Can use the gradient to find surface normal(s).
- Unless otherwise specified, all locations are in meters.

Due Wednesday, November 13, 2024