

EENG232
ELECTROMAGNETICS I
HW3

Date: 20/05/2017

Due: 25.05.2017

Consider the spherical capacitor. The inner conductor of the capacitor ($r < a$) is at potential V_0 Volts, while the outer one ($r = b$) is at $V = 0$ Volts. The region between the conductors is a lossy dielectric defined by the parameters ϵ, σ .

- a) Use the Laplace's equation $\nabla^2 V = 0$ to find the potential distribution within the region between the conductors.
- b) Use $\vec{E} = -\nabla V$ to determine the electric field between the conductors.
- c) Find the surface charge on the inner conductor by using $\rho_s = \epsilon E_n$ at $r = a$ and calculate the total charge on the inner conductor.
- d) Evaluate the capacitance of this capacitor.
- e) Find the leakage resistance by using $RC = \frac{\epsilon}{\sigma}$.
- f) Use $\vec{J} = \sigma \vec{E}$ to determine the conduction current density in the lossy material.
- g) Find the current from the current density $I = \int_s \vec{J} \cdot \hat{n} ds$.
- h) Calculate the leakage resistance by using $R = \frac{V}{I}$.
- i) Calculate the dissipated power in the lossy region.

Have a nice weekend ☺