

ECEn 360
Lines and Fields
Homework #2

1. Text: Problem 4.39
2. If the electric field is given by $\vec{E} = xy^2z \hat{x} + x^2yz \hat{y} + f \hat{z}$. What is a valid function for f ?
3. What is the voltage between the points $P_1=(1,1,1)$ and $P_2=(2,2,2)$ if the electric field is given by $\vec{E} = yz\hat{x} + xz\hat{y} + xy\hat{z}$?
4. A coaxial cable is constructed that has a constant electric field between the conductors. What is the relative electrical permittivity, ϵ_r , as a function of radius?
5. Text: Problem 4.52
6. Text: Problem 4.54

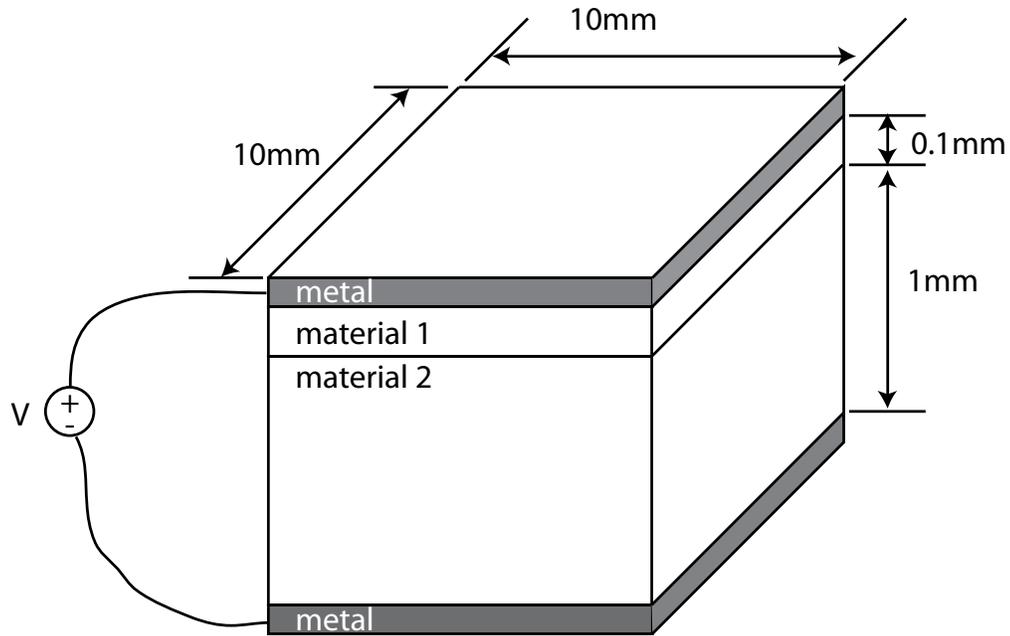


Figure 1

7. A high DC voltage is applied to the slab of material shown in Figure 1. The top and bottom metal layers are assumed to be perfect conductors ($\epsilon_r=1$, $\sigma=\infty$). Material 1 has the properties $\epsilon_r=1.6^2$, $\sigma=10^{-8}\text{S/m}$, $E_{ds}=10\text{MV/m}$. Material 2 has the properties $\epsilon_r=1.5^2$, $\sigma=10^{-12}\text{S/m}$, $E_{ds}=20\text{MV/m}$. The applied DC voltage is increased to the point immediately before dielectric breakdown occurs for either material 1 or material 2.
- What is the circuit model for this problem? This model should include a voltage source, and resistors and capacitors.
 - What is the voltage being supplied?
 - What is the electric field in material 1?
 - What is the current being supplied by the voltage source?