

task_ddjurcpk494go2q1_with_calculation

Student Group

First Name	Surname	Matrikel Nr.

Table of Contents

Exercise E1 Capacitor (written test, approx. 12 % of a 120-minute written test, SS2024)	 2
---	---------

electric field, magnetic field, exam ee2 SS2024

Exercise E1 Capacitor**(written test, approx. 12 % of a 120-minute written test, SS2024)**

A. On the left, the voltage of the cable is given. The cable is filled by layers of dielectric. The diagram shows the cable with the origin in the center of the coax cable. Due to the given voltage, the following is given: $\epsilon_{\text{air}} = 1$, while the distance between the plates remains the same. Give a generalized formula

For the conductor: $A = 1.1 \text{ mm}^2$, $r_{\text{air}} = 0.3 \text{ mm}$, $r_{\text{c}} = 0.5 \text{ mm}$. Current into the plane of the diagram is $I = 0.1 \text{ A}$. The displacement field is given by $D = \epsilon_0 \epsilon_{\text{air}} E$. The resulting capacitance C is now $C = \frac{Q}{U} = \frac{1.1 \text{ mm}^2 \cdot 1.1 \text{ V}}{0.1 \text{ A} \cdot 0.1 \text{ s}} = 1.21 \text{ F}$. Therefore: $C = \frac{1}{\frac{1}{C_{\text{air}}} + \frac{1}{C_{\text{c}}}}$

With $C_{\text{air}} = \epsilon_0 \epsilon_{\text{air}} \frac{A}{d}$ and $C_{\text{c}} = \epsilon_0 \epsilon_{\text{c}} \frac{A}{d}$ we get: $C = \frac{1}{\frac{1}{\epsilon_0 \epsilon_{\text{air}} \frac{A}{d}} + \frac{1}{\epsilon_0 \epsilon_{\text{c}} \frac{A}{d}}} = \frac{\epsilon_0 A d}{\frac{1}{\epsilon_{\text{air}}} + \frac{1}{\epsilon_{\text{c}}}}$

This leads to: $C = \epsilon_0 A d \frac{\epsilon_{\text{air}} \epsilon_{\text{c}}}{\epsilon_{\text{air}} + \epsilon_{\text{c}}}$

1. What is the magnitude of the magnetic field strength H at $r = (-0.1 \text{ mm} | 0)$ and $r = (0.55 \text{ mm} | 0)$?
2. Plot the graph of the magnitude of $H(x)$ from $r = (-0.6 \text{ mm} | 0)$ to $r = (0.6 \text{ mm} | 0)$ in one diagram. Use proper dimensions and labels for the diagram!
3. What is the magnitude of the electric displacement field D at $r = (-0.1 \text{ mm} | 0)$ and $r = (0.55 \text{ mm} | 0)$?

4. Plot the graph of the magnitude of $D(x)$ from $x = -0.6 \text{ mm}$ to $x = 0.6 \text{ mm}$ in one diagram. Use proper dimensions and labels for the diagram!

Path

```
\begin{align*} C &= \epsilon_0 \epsilon_r \frac{A}{d} \quad \text{with } \epsilon_r = 8.854 \cdot 10^{-12} \text{ As/Vm} \\ &\quad \cdot \frac{25 \cdot 10^{-6} \text{ m}}{200 \cdot 10^{-6} \text{ m}} \end{align*}
```

From:

<https://first.mexle.te.hs-heilbronn.de/> - MEXLE Wiki

Permanent link:

https://first.mexle.te.hs-heilbronn.de/ee2/task_ddjurcpk494go2q1_with_calculation?rev=1721055469

Last update: **2024/07/15 16:57**

