task_ddjurcpk494go2q1_with_calculation

Student Group

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Table of Contents

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electric field, magnetic field, exam ee2 SS2024

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

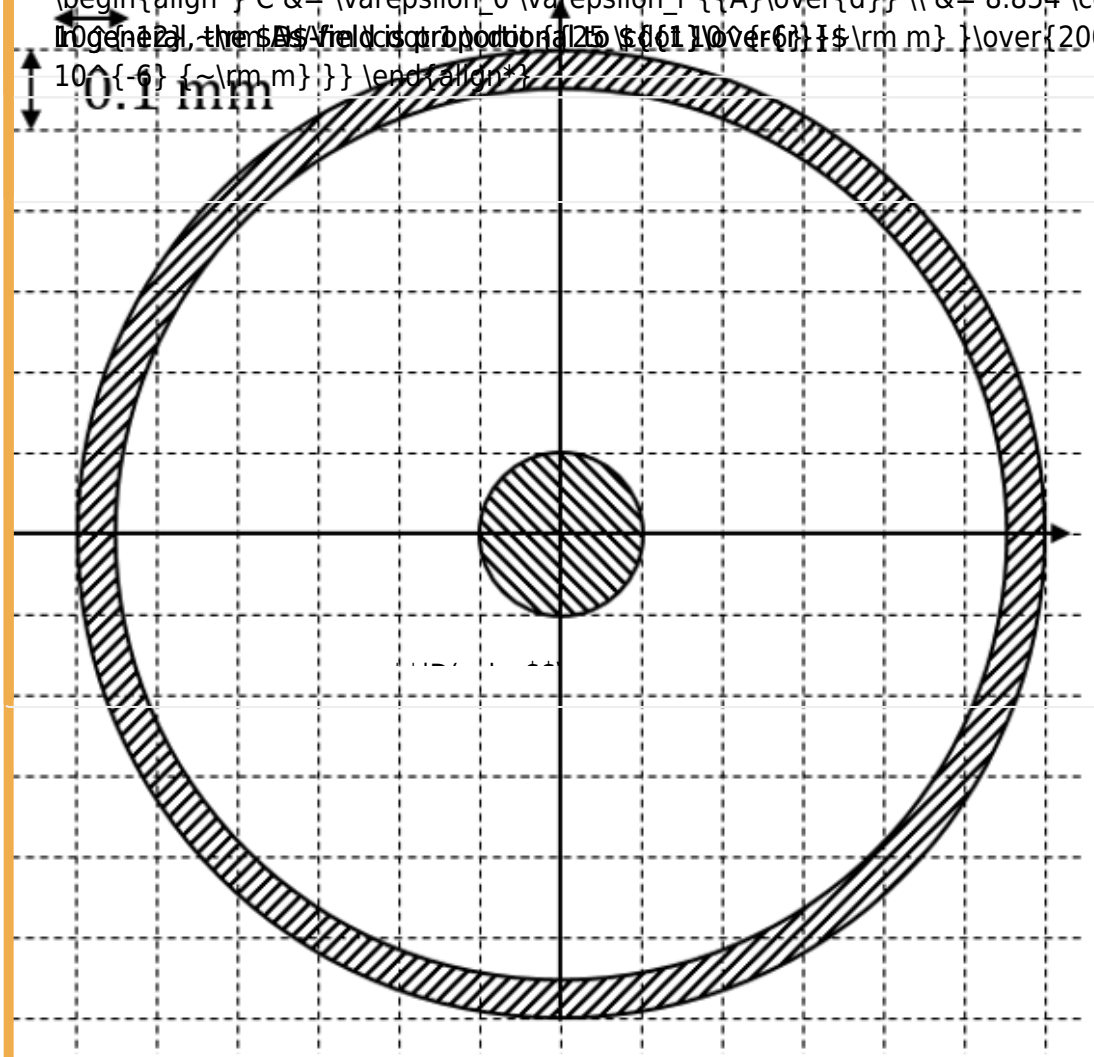
2. What is the magnitude of the magnetic field strength H at $\rm (0.6 ~mm | 0)$ and $\rm (1.05 ~mm | 0)$?

Result:

- Inner conductor: $+3.3 ~\rm mA$, $+10 ~\rm nC$ (current into the plane of the diagram)
  - $H_{\rm i} = 5.25... ~\rm A/m$
- Outer conductor: $-3.3 ~\rm mA$, $ 0 ~\rm nC$ (current out of the plane of diagram)
  - $H_{\rm o} = 0.955... ~\rm A/m$

$$\begin{aligned} C &= \varepsilon_0 \varepsilon_r {{A}\over{d}} \\ &= 8.854 \cdot 10^{-12} {{\rm As}\over{\rm Vm}} {{\pi \cdot 25 \cdot 10^{-6} {~\rm m} }\over{200 \cdot 10^{-6} {~\rm m} }} \end{aligned}$$

In general, the H-field is proportional to $\frac{1}{r}$.



1. What is the magnitude of the magnetic field strength H at $\rm (-0.1 ~mm | 0)$ and $\rm (0.55 ~mm | 0)$?

Path

The magnitude of the magnetic field strength H can be calculated by: $H = {{I}\over{2 \pi \cdot r}} $
So:

\begin{align*} H_{\rm i} &= {{I}\over{2 \pi \cdot r_{\rm i}}} \\ &= {{+3.3 A}\over{2 \pi \cdot { 0.1 \cdot 10^{-3}~\rm m}}} \\ H_{\rm o} &= {{I}\over{2 \pi \cdot r_{\rm o}}} \\ &= {{+3.3 A}\over{2 \pi \cdot { 0.55 \cdot 10^{-3}~\rm m}}} \\ \end{align*}

Hint: For the direction, one has to consider the right-hand rule. By this, we get that the H-field on the right side points downwards.
Therefore, the sign of the H-field is negative.
But here, only the magnitude was questioned!