

# 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

qq

electric field, magnetic field, exam ee2 SS2024

**Exercise E1 Capacitor**

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

2. With the graph of the magnitude of the magnetic field strength  $B$  of the diagram, the cross-section of the inner conductor is  $0.6 \text{ mm}$  in diameter. The diagram shows the cross-section of the inner conductor with the origin  $(0,0)$  in the center of the conductor. The diagram is a coordinate system with the  $x$ -axis pointing to the right and the  $y$ -axis pointing upwards. The diagram shows a shaded circular region representing the inner conductor, centered at the origin. The diameter of the inner conductor is  $0.6 \text{ mm}$ . The diagram also shows a dashed circle representing the outer conductor, centered at the origin. The diagram shows the magnitude of the magnetic field strength  $B$  as a function of the radial distance  $r$  from the origin. The graph shows that the magnetic field strength is zero at  $r = 0$  and increases linearly to a maximum value of  $5.25 \text{ A/m}$  at  $r = 0.3 \text{ mm}$ . The magnetic field strength then decreases linearly to zero at  $r = 0.6 \text{ mm}$ . The diagram shows that the magnetic field strength is zero for  $r > 0.6 \text{ mm}$ .

Path

- Inner conductor:  $+3.3 \text{ mA}$ ,  $+10 \text{ nC}$  (current into the plane of the diagram)
- Outer conductor:  $-3.3 \text{ mA}$ ,  $0 \text{ nC}$  (current out of the plane of diagram)

Path

- $H_{\text{in}} = 5.25 \text{ A/m}$
- $H_{\text{out}} = 0.955 \text{ A/m}$

$C = \frac{\epsilon_0 \epsilon_r A}{d} = 8.854 \cdot 10^{-12} \frac{\text{F}}{\text{m}} \cdot \frac{10^{-6} \text{ m}^2}{200 \cdot 10^{-6} \text{ m}} = 4.427 \cdot 10^{-14} \text{ F}$

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

.. What is the magnitude of the magnetic field strength  $B$  at  $(-0.1 \text{ mm} | 0)$  and  $(0.55 \text{ mm} | 0)$ ?

Path

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

So:

$$\begin{aligned} H_{\text{in}} &= \frac{I}{2 \pi \cdot r_{\text{in}}} \quad \&= \quad \frac{+3.3 \text{ A}}{2 \pi \cdot \{ 0.1 \cdot 10^{-3} \text{ m} \}} \quad \& H_{\text{out}} &= \frac{I}{2 \pi \cdot r_{\text{out}}} \quad \&= \quad \frac{+3.3 \text{ A}}{2 \pi \cdot \{ 0.55 \cdot 10^{-3} \text{ m} \}} \quad \end{aligned}$$

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!

From:

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

Permanent link:

[https://mexle.te.hs-heilbronn.de/ee2/task\\_ddjurcpk494go2q1\\_with\\_calculation?rev=1721064963](https://mexle.te.hs-heilbronn.de/ee2/task_ddjurcpk494go2q1_with_calculation?rev=1721064963)

Last update: **2024/07/15 19:36**

