

# task\_ti7loik6aurfewkb\_with\_calculation

## Student Group

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## magnetostatic, flux density, exam ee2 SS2021

**Exercise E1 Magnetic Flux Density****(written test, approx. 6 % of a 120-minute written test, SS2021)**

A) The electric power is operated for an experiment in the laboratory. A resistor  $R = 100 \text{ }\Omega$  with a current of  $\hat{I} = 100 \text{ A}$  is operated.

What is the distance to the cable and the cable to which this value has been reached? (3 points, independent) The figure below shows the supply line between  $A$  and  $B$  and its position.

$$B = 0.12 \text{ A} \cdot \mu_0 \cdot I \cdot 10^{-7} \left\{ \frac{\text{Vs}}{\text{Am}} \right\}, \mu_r = 1$$

The formula for the magnetic field strength can be rearranged: 
$$H = \frac{I}{2\pi \cdot r} \quad r = \frac{I}{2\pi \cdot H}$$

Again, the magnetic flux density  $B$  is given as:  $B = \mu_0 \cdot \mu_r \cdot H$

Therefore: 
$$r = \frac{\mu_0 \cdot \mu_r \cdot I}{2\pi \cdot B} \quad r = \frac{4\pi \cdot 10^{-7} \left\{ \frac{\text{Vs}}{\text{Am}} \right\} \cdot \{100 \text{ A}\}}{2\pi \cdot 100 \cdot 10^{-6} \left\{ \text{T} \right\}}$$

a) What is the highest magnetic flux density through the line in your body? (3 points)

Path

The magnetic field strength for a conducting wire is given as:

$$\begin{align*} H &= \frac{I}{2\pi \cdot r} \end{align*}$$

The magnetic flux density  $B$  is given as:  $B = \mu_0 \mu_r H$

Here, the maximum current is  $\hat{I} = 100 \text{ ~\rm A}$  and the distance to the cable is  $r = \sqrt{(0.1 \text{ ~\rm m})^2 + (0.4 \text{ ~\rm m})^2} = 0.412... \text{ ~\rm m}$ .

Therefore: 
$$B = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot 1 \cdot \frac{100 \text{ ~\rm A}}{2\pi \cdot 0.412... \text{ ~\rm m}}$$

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Last update: **2024/07/01 14:01**

