

task_0j7accfimmemytq9_with_calculation

Student Group

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magnetostatic, flux density, magnetic field strength, coil, flux, exam ee2 SS2021

Exercise E1 Cylindrical Coil (written test, approx. 6 % of a 120-minute written test, SS2021)

A) The magnetic flux (2 points) information is given:

Result

- Length $l = 30 \text{ cm}$,

Path Winding diameter $d = 390 \text{ mm}$,

- Number of windings $N = 240$,
- Current in the conductor $I = 500 \text{ mA}$.

Material inside: Air

$$\mu_0 = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}}$$

The magnetic field strength $H = \mu_r \mu_0^{-1} \cdot B$

The proportion of the magnetic voltage outside the coil can be neglected. Determine the following for the inside of the coil:

a) the magnetic field strength (2 points)

$$B = \mu_0 \cdot N \cdot I \cdot \frac{d}{2} = 4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}} \cdot 240 \cdot 0.5 \frac{\text{m}}{2} = 0.0005026... \frac{\text{Vs}}{\text{m}^2}$$

$$A = \pi r^2 = \pi \left(\frac{d}{2} \right)^2$$

path

$$\Phi = B \cdot A = B \cdot \pi \left(\frac{d}{2} \right)^2$$

$$\Phi = 0.0005026... \frac{\text{Vs}}{\text{m}^2} \cdot \pi \left(\frac{0.39 \text{ m}}{2} \right)^2 = 0.00006004... \text{ Vs}$$

$$H = \frac{B}{\mu_0} = \frac{0.0005026... \frac{\text{Vs}}{\text{m}^2}}{4\pi \cdot 10^{-7} \frac{\text{Vs}}{\text{Am}}} = 10000 \text{ A/m}$$

$$H = \frac{240 \cdot 0.5 \text{ A}}{0.3 \text{ m}} = 400 \text{ A/m}$$

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