

## VE230 — Electromagnetics I

### Homework 6

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a)

$$R_g = \frac{l_g}{\mu_0 A} = \frac{3 \text{ mm}}{4\pi \times 10^{-7} \text{ H/m} \cdot \pi(25 \text{ mm})^2} = 1.216 \times 10^6 \text{ H}^{-1}.$$

$$R_c = \frac{l_c}{\mu_0 \mu_c A} = \frac{(2\pi \cdot 80 - 3) \text{ mm}}{4\pi \times 10^{-7} \text{ H/m} \cdot 3000 \cdot \pi(25 \text{ mm})^2} = 6.75 \times 10^4 \text{ H}^{-1}.$$

b)

$$\mathbf{B}_g = \mathbf{B}_c = \mathbf{a}_\phi \frac{\Phi}{A} = \mathbf{a}_\phi \frac{1 \times 10^{-5} \text{ Wb}}{\pi(25 \text{ mm})^2} = 5.093 \times 10^{-3} \text{ T},$$

$$\mathbf{H}_g = \frac{\mathbf{B}_g}{\mu_0} = \frac{5.093 \times 10^{-3} \text{ T}}{4\pi \times 10^{-7} \text{ H/m}} = 4.052 \times 10^3 \text{ A/m},$$

$$\mathbf{H}_c = \frac{\mathbf{B}_c}{\mu_0 \mu_c} = \frac{5.093 \times 10^{-3} \text{ T}}{3000 \cdot 4\pi \times 10^{-7} \text{ H/m}} = 1.351 \times 10^3 \text{ A/m}.$$

c)

$$\Phi = BA = \frac{N I_0}{R_g + R_c},$$

$$I_0 = \frac{\Phi(R_g + R_c)}{N} = \frac{1 \times 10^{-5} \text{ Wb} \cdot (1.216 \times 10^6 \text{ H}^{-1} + 6.75 \times 10^4 \text{ H}^{-1})}{500} = 2.567 \times 10^{-2} \text{ A}.$$

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