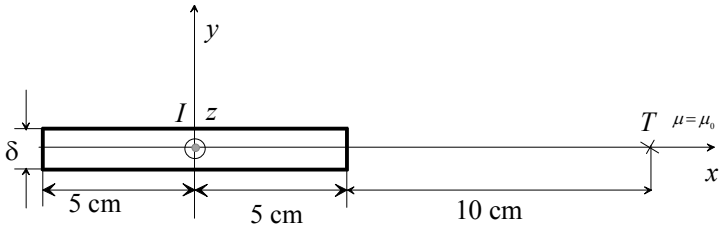
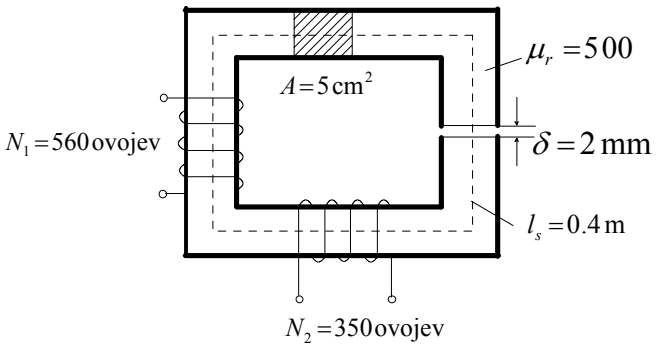
OSNOVE ELEKTROTEHNIKE II

Izpit, 03. 12. 2002.

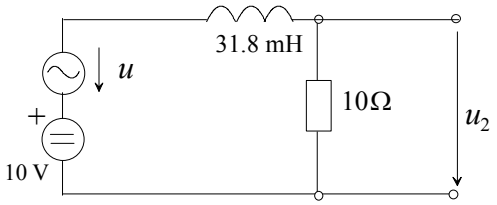
1. Po prevodnem traku širine 10 cm $(\delta = 1\,\text{mm})$ teče tok I = 20 A. Kolikšen je vektor gostote magnetnega pretoka $\vec{B}$ v točki T 10 cm od traku? $\left(\int \frac{dx}{x} = \ln x + C\right)$



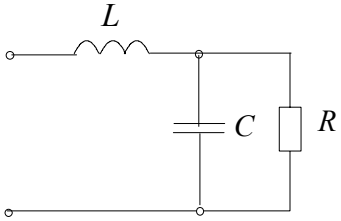
2. Relativna permeabilnost narisanega jedra je 500. Kolikšna je medsebojna induktivnost navitij na jedru, če računamo s homogenim poljem v zračni reži?



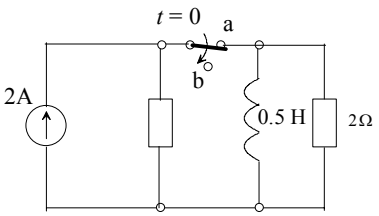
3. Kolikšna je napetost $u_2(t)$? $u = 10\cos 100\pi t$ V . (Napotek: superpozicija)



4. Pri kateri frekvenci vzbujanja bo impedanca vezja čisto ohmska?



5. Koliko toplote se sprosti na uporu R = 2 Ω med prehodnim pojavom po preklopu stikala iz položaja a v položaj b?



OSNOVE ELEKTROTEHNIKE II

Izpit, 03. 12. 2002. - Rešitve

1. $2a = 2 \cdot 5\,\text{cm}, d = 10\,\text{cm}$

$$d\vec{B} = \vec{e}_y \frac{\mu_0}{2\pi} \cdot \frac{dI}{x}$$

$$dI = \frac{I}{2a} \cdot dx$$

$$\vec{B} = \vec{e}_y \frac{\mu_0 I}{2\pi \cdot 2a} \int_d^{d+2a} \frac{dx}{x} = \vec{e}_y \frac{\mu_0 I}{4\pi a} \ln \frac{d+2a}{d}$$

$$\vec{B} = \vec{e}_y \frac{4\pi \cdot 10^{-7} \cdot 20}{4\pi \cdot 0.05} \ln \frac{0.2}{0.1} = \vec{e}_y \, 27.7\,\mu\text{T}$$

2. $M = N_2 \cdot \Phi_{12} / I_1$

$$B_{Fe} = B_0 = B$$

$$I_1 N_1 = H_{Fe} \cdot l_{Fe} + H_0 \cdot \delta = \frac{B_{Fe}}{\mu_0 \mu_r} \cdot l_{Fe} + \frac{B_0}{\mu_0} \cdot \delta = \frac{B}{\mu_0} \left(\frac{l_{Fe}}{\mu_r} + \delta \right)$$

$$B = I_1 N_1 \frac{\mu_0}{l_{Fe}/\mu_r + \delta}$$

$$\Phi_{12} = BA$$

$$M = N_1 N_2 A \frac{\mu_0}{l_{Fe}/\mu_r + \delta} = 560 \cdot 350 \cdot 5 \cdot 10^{-4} \frac{4\pi \cdot 10^{-7}}{0.4/500 + 0.002}$$

$$M = 43.98\,\text{mH}$$

3. $Z = R + \text{j}\omega L = 10 + \text{j}10\,\Omega$

$$\underline{I}_m = \frac{10}{10 + \text{j}10} = 0.5(1 - \text{j})\text{A}$$

$$\text{i} = 0.71 \cos(100\pi\,\text{t} - 45^0)\text{A}$$

$$\text{u}_2 = 10 + 7.1 \cos(100\pi\,\text{t} - 45^0)\text{V}$$

4. $$\underline{Z} = \text{j}\omega L + \frac{R}{1 + \text{j}\omega RC} = \frac{R + \text{j}\left(\omega L\left(1 + \omega^2 R^2 C^2\right) - \omega R^2 C\right)}{1 + \omega^2 R^2 C^2}$$

$$\text{Im}(\underline{Z}) = 0$$

$$\omega L\left(1 + \omega^2 R^2 C^2\right) - \omega R^2 C = 0$$

$$\omega = \frac{1}{RC} \sqrt{\frac{R^2 C}{L} - 1}$$

5. Na uporu se potroši energija, ki je v magnetnem polju tuljave.

$$W_L = \frac{1}{2} I^2 L = \frac{1}{2} \cdot 2^2 \cdot 0.5 = 1\,\text{J}$$

$$A_R = W_L = 1\,\text{J}$$