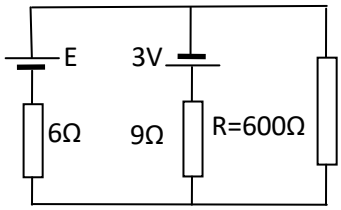
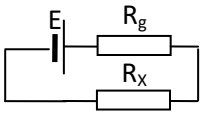
Računski deo ispita iz Tehničke fizike **grupa A** **2.03.2026.**

1. U kolu na slici odrediti E tako da kroz otpornik R ne protiče struja.



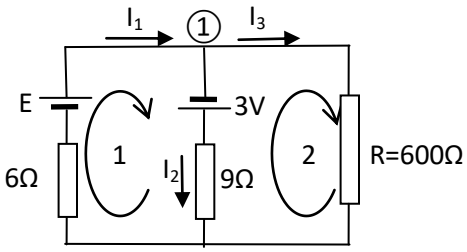
2. U kolu na slici odrediti otpornost R_X tako da se na njemu razvija maksimalna snaga i odrediti tu snagu. Poznato je: R_g=1Ω, E=12V.



3. Kolika količina elektriciteta protekne kroz konturu električne otpornosti 3,14Ω, prečnika 0,6mm kada se okrene iz položaja maksimalnog u položaj nultof magnetnog fluksa u homogenom magnetnom polju indukcije 30μT?
4. Otpornik otpornosti 300Ω, kalem induktivnosti *L* i kondenzator kapaciteta *C* vezani su redno. Pri merenju impedanse ove veze ustanovljeno je da je ona najmanja na frekvenciji od 300Hz. Odrediti induktivnost kalema i kapacitet kondenzatora ako je pri frekvenciji 500Hz impedansa kola 500Ω.

Rešenja

1. Primenom Kirhofovih zakona imamo:



$$\left.\begin{array}{ll} Cvor\,1 & I_1 - I_2 - I_3 = 0 \\ \text{Kontura } 1 & 6I_1 + 9I_2 = E + 3 \\ \text{Kontura } 2 & -9I_2 + 600I_3 = -3 \end{array}\right\}$$

$$\left.\begin{array}{l} 6(I_2 + I_3) + 9I_2 = E + 3 \\ -9I_2 + 600I_3 = -3 \end{array}\right\} \Rightarrow \left.\begin{array}{l} 15I_2 + 6I_3 = E + 3 \\ -9I_2 + 600I_3 = -3 \end{array}\right\} \Rightarrow I_3 = \frac{E-2}{1006} = 0 \Rightarrow E = 2V$$

2. $P(R_X) = R_X I^2 = R_X \dfrac{E^2}{(R_g + R_X)^2}$ $\qquad \dfrac{dP}{dR_x} = 0 \Rightarrow \dfrac{d}{dR_X}(E^2 R_X (R_g + R_X)^{-2}) = 0$

$(R_g + R_X)^{-2} - 2R_X(R_g + R_X) = 0 \Rightarrow R_X = R_g = 1\Omega$, $\qquad P_{\max} = 1\Omega \dfrac{12^2}{2^2} W = 36W$

3. $e = -\dfrac{d\Phi}{dt} = -\dfrac{\Delta\Phi}{\Delta t} = -\dfrac{\Phi_2 - \Phi_1}{\Delta t} = \dfrac{\Phi_1 - \Phi_2}{\Delta t}$ $\qquad e = i \cdot R = \dfrac{\Delta q}{\Delta t} R = \dfrac{\Phi_1 - \Phi_2}{\Delta t} \Rightarrow \Delta q = \dfrac{\Phi_1 - \Phi_2}{R}$, $\Phi_2 = 0$

$$\Delta q = \frac{\Phi_1}{R} = \frac{B \cdot S}{R} = \frac{3 \cdot 10^{-5} T \cdot \pi \cdot (6 \cdot 10^{-4})^2 m^2}{4 \cdot 3{,}14\Omega} = 2{,}7 \cdot 10^{-12} C$$

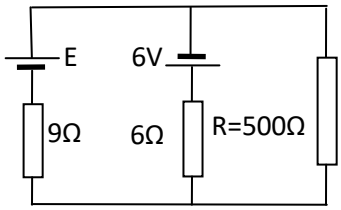
4. Impendansa je minimalna na rezonantnoj frekvenciji tj. kada je $L\omega - 1/C\omega = 0 \Rightarrow LC = \dfrac{1}{\omega_{rez}^2}$.

$LC = \dfrac{1}{4\pi^2 \cdot 300^2} = 2{,}814477 \cdot 10^{-7} s^2/rad^2$. $Z = \sqrt{R^2 + X^2} \Rightarrow 500^2 = 300^2 + X^2 \Rightarrow X = L\omega - \dfrac{1}{C\omega} = \begin{cases} 400\Omega \\ -400\Omega \end{cases}$

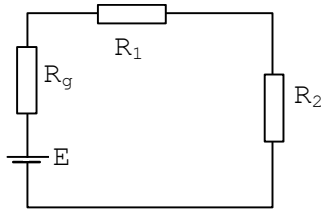
$L\omega - \dfrac{L\omega_{rez}^2}{\omega} = X \Rightarrow L = \dfrac{\omega X}{\omega^2 - \omega_{rez}^2} = \dfrac{2\pi \cdot f \cdot 400}{4\pi^2 \left(f^2 - f_{rez}^2\right)} = \dfrac{500 \cdot 400}{2\pi \cdot (500^2 - 300^2)} = 198{,}94 \cdot 10^{-3} H$, $C = \dfrac{1}{L\omega_{rez}^2} = 1{,}41471 \cdot 10^{-6}\,\mathrm{F}$

Računski deo ispita iz Tehničke fizike **grupa B** **2.03.2026.**

1. U kolu na slici odrediti E tako da kroz otpornik R ne protiče struja.

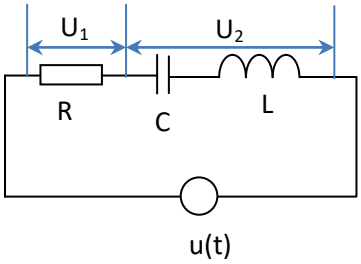


2. U električnom kolu jednosmerne struje, prikazano na slici, odrediti vrednost otpornosti otpornika R_1 tako da snaga toplotnih gubitaka na ovom otporniku bude maksimalna. Poznate su sledeće vrednosti u kolu: R_g=5Ω, R_2=1000Ω.



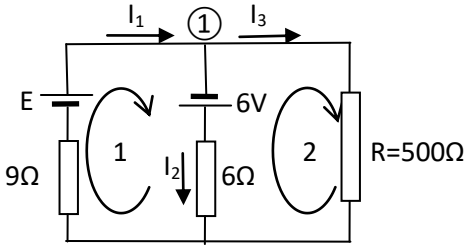
3. Kolika je magnetna indukcija homogenog magnetnog polja ako kroz konturu električne otpornosti 6,28Ω, poluprečnika 0,2mm protekne količina elektriciteta 6,4nC kada se okrene iz položaja maksimalnog u položaj nultog magnetnog fluksa?

4. U kolu na slici priključen je naizmenični napon od 220V frekvencije 50Hz. Struja u kolu je 5A a napon $U_2 = \sqrt{3}U_1$. Odrediti R i U_2.



Rešenja

1. Primenom Kirhofovih zakona imamo:



$$\left.\begin{array}{ll} Cvor\,1 & I_1 - I_2 - I_3 = 0 \\ \text{Kontura } 1 & 9I_1 + 6I_2 = E + 6 \\ \text{Kontura } 2 & -6I_2 + 500I_3 = -6 \end{array}\right\}$$

$$\left.\begin{array}{l} 9(I_2 + I_3) + 6I_2 = E + 6 \\ -6I_2 + 500I_3 = -6 \end{array}\right\} \Rightarrow \left.\begin{array}{l} 15I_2 + 9I_3 = E + 6 \\ -6I_2 + 500I_3 = -6 \end{array}\right\} \Rightarrow I_3 = \frac{E-9}{1259} = 0 \Rightarrow E = 9V$$

2. $I = \dfrac{E}{R_g + R_1 + R_2} = \dfrac{E}{1005 + R_1}$ $\qquad P_{R_1} = R_1 I^2 = R_1 \dfrac{E^2}{(1005 + R_1)^2}$. Uslov ekstrema $\dfrac{dP_{R_1}}{dR_1} = 0$

$$\frac{dP_{R_1}}{dR_1} = \frac{d}{dR_1}\left(E^2 R_1 (R_1 + 1005)^{-2}\right) = E^2\left[(R_1 + 1005)^{-2} + R_1(-2)(R_1 + 1005)^{-3}\right] = 0,\ 2R_1 = R_1 + 1005 \Rightarrow R_1 = 1005\Omega$$

3. $e = -\dfrac{d\Phi}{dt} = -\dfrac{\Delta\Phi}{\Delta t} = -\dfrac{\Phi_2 - \Phi_1}{\Delta t} = \dfrac{\Phi_1 - \Phi_2}{\Delta t}$ $\qquad e = i \cdot R = \dfrac{\Delta q}{\Delta t} R = \dfrac{\Phi_1 - \Phi_2}{\Delta t} \Rightarrow \Delta q = \dfrac{\Phi_1 - \Phi_2}{R}$, $\Phi_2 = 0$

$$\Delta q = \frac{\Phi_1}{R} = \frac{B \cdot S}{R} \Rightarrow B = \frac{R\Delta q}{S} = \frac{6{,}28 \cdot 6{,}4 \cdot 10^{-9}}{\pi \cdot (2 \cdot 10^{-4})^2} = 0{,}3198T$$

4. $U^2 = U_1^2 + U_2^2 = U_1^2 + 3U_1^2 = 4U_1^2$, $U_1 = U/2$.

$$U_2 = \sqrt{3} \cdot 220/2 = 190{,}525\text{V},\quad R = \frac{U_1}{I} = \frac{U}{2I} = \frac{220}{2 \cdot 5}\Omega = 22\Omega$$