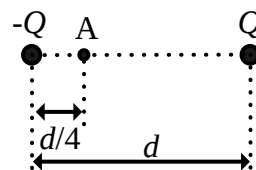


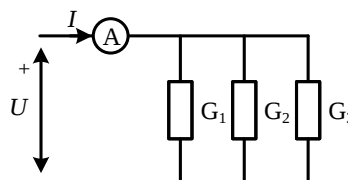
Elektrotehnika – teorijski deo ispita

7. jul 2026.

1. (6 poena) Dva tačkasta naelektrisanja, naelektrisana količinama naelektrisanja $Q > 0$ i $-Q < 0$, nalaze se u vazduhu na rastojanju d . Odrediti izraze za intenzitet električnog polja i potencijal u tački A koja je kolinearna sa ova dva naelektrisanja i udaljena od negativnog naelektrisanja za $d/4$.

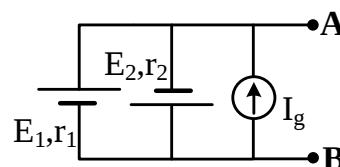


2. (6 poena) Za deo kola jednosmerne struje na slici, poznat je napon $U = 10 \text{ V}$ i provodnosti $G_1 = 1 \text{ mS}$, $G_2 = 2 \text{ mS}$, $G_3 = 3 \text{ mS}$. Odrediti vrednost koju pokazuje idealni ampermetar.

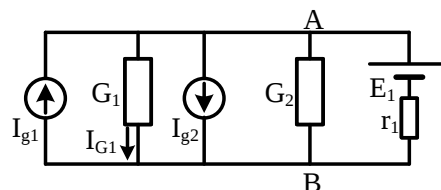


3. (7 poena) Za kolo na slici, između tačaka A i B, nacrtati ekvivalentni Thvenenov generator i odrediti njegove parametre, E_T i R_T .

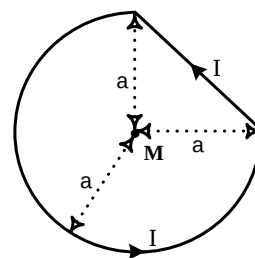
Vrednosti parametara: $E_1 = 10 \text{ V}$, $E_2 = 20 \text{ V}$, $r_1 = r_2 = 10 \Omega$ i $I_g = 3 \text{ A}$.



4. (7 poena) U električnom kolu na slici poznate su vrednosti parametara svih elemenata u kolu. Primenom metode potencijala čvorova, odrediti najpre izraz za napon U_{AB} , a zatim i izraz za struju I_{G1} .



5. (6 poena) Kontura sa strujom I se sastoji od jednog pravolinijskog i jednog lučnog segmenta (tri četvrtine kružnice poluprečnika a), kao što je prikazano na slici. Odrediti intenzitet i skicirati vektor magnetne indukcije u tački M, ako se kontura nalazi u vazduhu.



6. Kroz kalem induktivnosti 5 mH protiče naizmenična struja $i(t) = 4 \cos(200t - \pi/2) \text{ A}$.

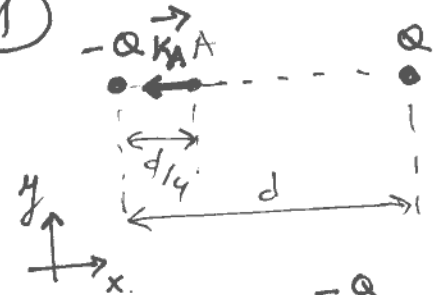
a) (4 poena) Odrediti kompleksne predstavnike napona i struje kalema.

b) (2 poena) Nacrtati fazorski dijagram napona i struje kalema.

7. (6 poena) Kroz potrošač nepoznate impedanse protiče struja intenziteta $i(t) = 50 \cos(500t + \pi/2) \text{ A}$, dok napon na njegovim krajevima iznosi $u(t) = 100\sqrt{2} \cos(500t + \pi/4) \text{ V}$. Odrediti faktor snage i reaktivnu snagu potrošača.

8. (6 poena) Odrediti impedansu i faktor snage redne veze 10 elemenata: 5 otpornika pojedinačne konduktanse 0.5 S i pet kalemova pojedinačne reaktanse 2Ω .

①

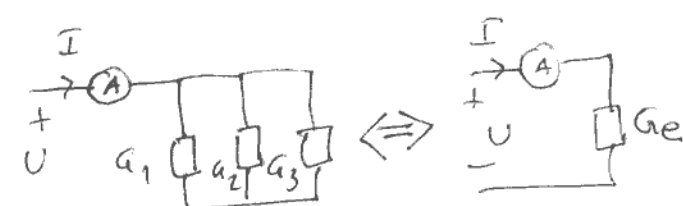


$$\vec{K}_A = \frac{-Q}{4\pi\epsilon_0 \left(\frac{d}{4}\right)^2} (\vec{i}) + \frac{Q}{4\pi\epsilon_0 \left(\frac{3d}{4}\right)^2} (-\vec{i})$$

$$\vec{K}_A = -\frac{40Q}{9\pi\epsilon_0 d^2} \vec{i} \Rightarrow |\vec{K}_A| = \frac{40Q}{9\pi\epsilon_0 d^2}$$

$$V_A = \frac{-Q}{4\pi\epsilon_0 \frac{d}{4}} + \frac{Q}{4\pi\epsilon_0 \frac{3d}{4}} = -\frac{2Q}{3\pi\epsilon_0 d}$$

②

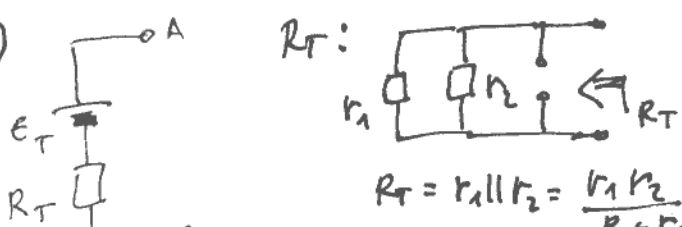


$$G_e = G_1 + G_2 + G_3 = 6 \text{ mS}$$

$$I = G_e \cdot U = 6 \text{ m} \cdot 10 = 60 \text{ mA}$$

(AMPERMETAR MERI STRUJU I)

③

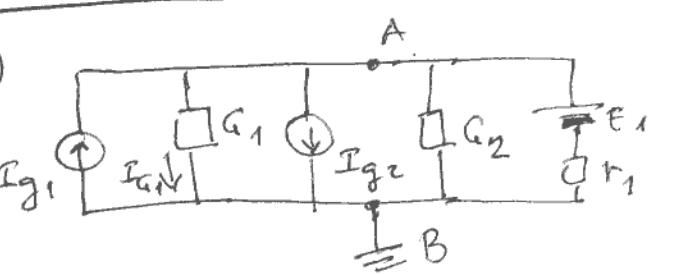


$$R_T = r_1 \parallel r_2 = \frac{r_1 r_2}{r_1 + r_2} = 5 \Omega$$

$$E_T: E_T = U_{AB} \quad \text{MPČ: } U_{AB} \left(\frac{1}{r_1} + \frac{1}{r_2} \right) = \frac{E_1}{r_1} - \frac{E_2}{r_2} + I_g$$

$$U_{AB} = \frac{E_1/r_1 - E_2/r_2 + I_g}{\frac{1}{r_1} + \frac{1}{r_2}} = 10 \text{ V}$$

④



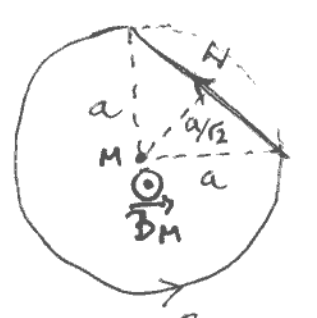
$$U_{AB} = V_A \quad (U_B = 0!)$$

$$V_A \left(\frac{1}{r_1} + G_2 + G_1 \right) = I_{g1} - I_{g2} + \frac{E_1}{r_1}$$

$$U_{AB} = V_A = \frac{I_{g1} - I_{g2} + E_1/r_1}{\frac{1}{r_1} + G_1 + G_2}$$

$$I_{G1} = G_1 U_{AB} = \frac{G_1 (I_{g1} - I_{g2} + E_1/r_1)}{\frac{1}{r_1} + G_1 + G_2}$$

⑤



$$B_M = |\vec{B}_M| = \frac{\mu_0 I}{2a} \cdot \frac{3}{4} + \frac{\mu_0 I}{4\pi \left(\frac{a}{\sqrt{2}}\right)} \left(\cos\left(\frac{\pi}{4}\right) + \cos\left(\frac{\pi}{4}\right) \right) \cdot 2 \cdot \frac{1}{\sqrt{2}}$$

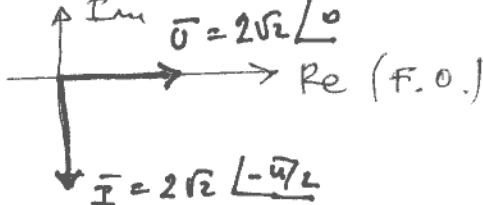
$$B_M = \underbrace{\frac{3\mu_0 I}{8a}}_{\text{krivini luk}} + \underbrace{\frac{\mu_0 I}{2\pi a}}_{\text{pravolinijski segment}} = \frac{\mu_0 I}{8a} \left(3 + \frac{4}{\pi} \right)$$

⑥ a) $\hat{Z}_L = j\omega L = j200 \cdot 5 \cdot 10^{-3} = j1 \Omega$

$$\vec{I} = \frac{4}{\sqrt{2}} e^{j\pi/2} = 2\sqrt{2} e^{j\pi/2} = -j2\sqrt{2} \text{ A}$$

$$\vec{U} = \hat{Z}_L \cdot \vec{I} = j(-j2\sqrt{2}) = 2\sqrt{2} \text{ V} = 2\sqrt{2} e^{j0} \text{ V}$$

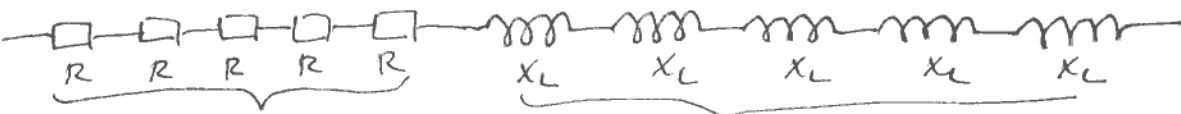
b)



$$\vec{I}_m = 2\sqrt{2} \angle -\frac{\pi}{2}$$

$$\vec{U} = 2\sqrt{2} \angle 0$$

$\textcircled{7} \quad \bar{I} = \frac{50}{\sqrt{2}} e^{j\pi/2} \text{ A} \quad \bar{S} = \bar{U} \bar{I}^* = \frac{50}{\sqrt{2}} \cdot 100 e^{j(\pi/4 - \pi/2)} = 2500\sqrt{2} e^{-j\pi/4} \text{ VA}$
 $\bar{U} = 100 e^{j\pi/4} \text{ V} \quad Q = 2500\sqrt{2} \sin(-\pi/4) = -2500 \text{ VAR}$
 FAKTOR SNAGE: $\cos(\varphi) = \cos(-\pi/4) = \frac{\sqrt{2}}{2}$

$\textcircled{8}$


 $R_e = 5R = 10 \Omega \quad X_e = X_L \cdot 5 = 10 \Omega \quad Z_e = |\bar{Z}_e| = 10\sqrt{2} \Omega$
 $R = \frac{1}{G} = \frac{1}{0,5} = 2 \Omega \quad \bar{Z}_e = R_e + jX_e = (10 + j10) \Omega \quad \cos\varphi = \frac{R_e}{Z_e} = \frac{\sqrt{2}}{2}$