

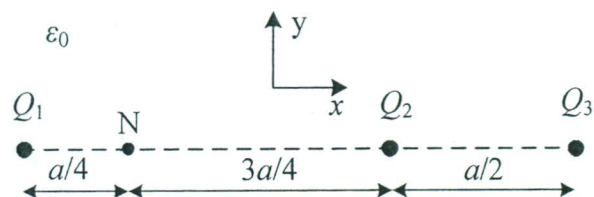
PRVI KOLOKVIJUM IZ ELEKTROTEHNIKE

26. novembar 2018.

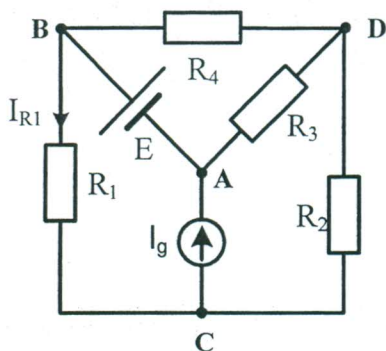
GRUPA 2

1. Na Slici 1 prikazan je sistem sa tri tačkasta naelektrisanja:  $Q_1 = Q$ ,  $Q_2 = 9Q$  i  $Q_3 = -5Q$ ,  $Q > 0$ , koja se nalaze u vazduhu, na istoj pravoj.

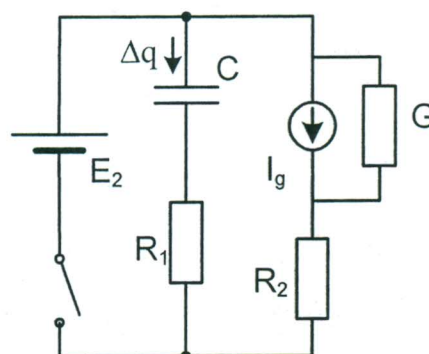
- Odrediti i nacrtati vektor električnog polja u tački N. (6 poena)
- Odrediti potencijal električnog polja u tački N. (4 poena)



Slika 1



Slika 2



Slika 3

2. U kolu na Slici 2 poznato je:  $R_1 = R_2 = R_3 = R_4 = R = 12 \Omega$ ,  $E = 24 \text{ V}$ ,  $I_g = 6 \text{ A}$ .

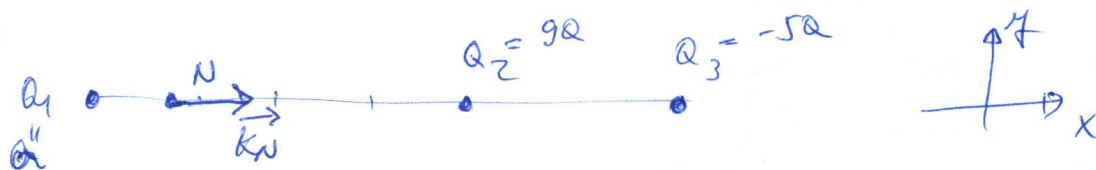
- Primenom Tevenenove teoreme odrediti intenzitet struje  $I_{R1}$  kroz otpornik  $R_1$ . (10 poena)
- Primenom metode superpozicije odrediti napon  $U_{DA}$ . (12 poena)

3. U kolu na Slici 3 poznato je:  $R_1 = 10 \Omega$ ,  $R_2 = 5 \Omega$ ,  $E_2 = 5 \text{ V}$ ,  $I_g = 1 \text{ A}$ ,  $G = 0.1 \text{ S}$ ,  $C = 20 \mu\text{F}$ . Prekidač je otvoren. Odrediti količinu naelektrisanja  $\Delta q$  koja će proteći kroz granu sa kondenzatorom nakon zatvaranja prekidača. (8 poena)

Izrada kolokvijuma traje 90 minuta. Nije dozvoljena upotreba digitrona. Na vežbanci napisati broj grupe zadatka. Papir sa tekstom zadatka predaje se u vežbanci tj. ne sme se izneti.

# GRUPA 2

1



$$a) \vec{K}_{N1} = \frac{Q}{4\pi\epsilon_0 \left(\frac{a}{4}\right)^2} \cdot \vec{i} = \frac{4Q}{\pi\epsilon_0 a^2} \vec{i}$$

$$\vec{K}_{N2} = \frac{9Q}{4\pi\epsilon_0 \left(\frac{3a}{4}\right)^2} (-\vec{i}) = \frac{-4Q}{\pi\epsilon_0 a^2} \vec{i}$$

$$\vec{K}_{N3} = \frac{-5Q}{4\pi\epsilon_0 \left(\frac{3a}{4} + \frac{a}{2}\right)^2} (-\vec{i}) = \frac{5Q}{4\pi\epsilon_0 \left(\frac{5a}{4}\right)^2} \vec{i} = \frac{4Q}{5\pi\epsilon_0 a^2} \vec{i}$$

$$\vec{K}_N = \vec{K}_{N1} + \vec{K}_{N2} + \vec{K}_{N3} = \left( \frac{4Q}{\pi\epsilon_0 a^2} - \frac{4Q}{\pi\epsilon_0 a^2} + \frac{4Q}{5\pi\epsilon_0 a^2} \right) \vec{i}$$

$$\vec{K}_N = \frac{4Q}{5\pi\epsilon_0 a^2} \vec{i}$$

b)

$$V_{N1} = \frac{Q}{4\pi\epsilon_0 \frac{a}{4}} = \frac{Q}{\pi\epsilon_0 a}$$

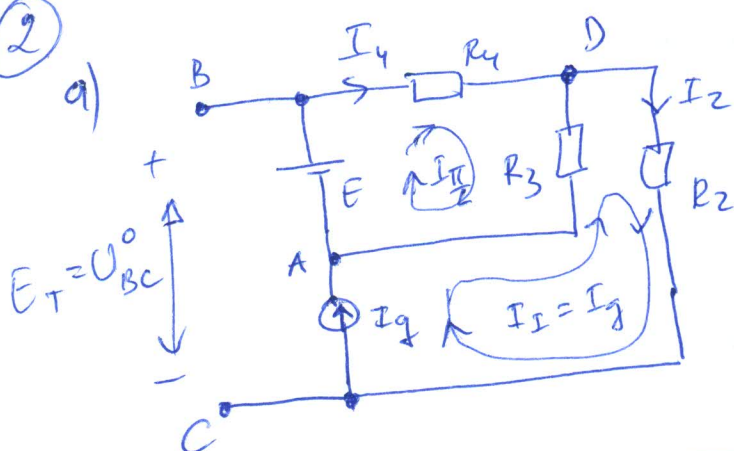
$$V_{N2} = \frac{9Q}{4\pi\epsilon_0 \frac{3a}{4}} = \frac{3Q}{\pi\epsilon_0 a}$$

$$V_{N3} = \frac{-5Q}{4\pi\epsilon_0 \left(\frac{3a}{4} + \frac{a}{2}\right)} = \frac{-5Q}{4\pi\epsilon_0 \frac{5a}{4}} = -\frac{Q}{\pi\epsilon_0 a}$$

$$V_N = V_{N1} + V_{N2} + V_{N3} = \frac{Q}{\pi\epsilon_0 a} + \frac{3Q}{\pi\epsilon_0 a} - \frac{Q}{\pi\epsilon_0 a} = \frac{3Q}{\pi\epsilon_0 a} = U_N$$

2

a)



$$E_T = U_{BC}^0$$

$$I_{II} = I_{I3} = 6A \Rightarrow I_{II} = I_{I1} = 6A$$

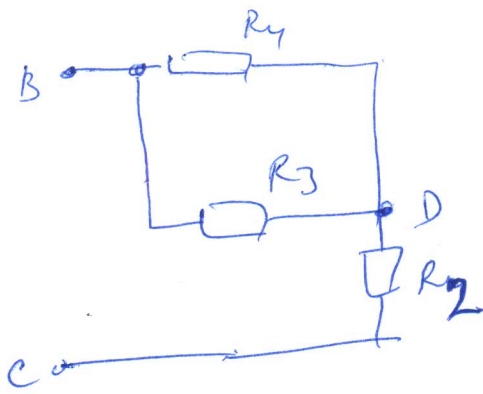
$$-R_3 I_{I1} + (R_3 + R_4) I_{II} = E$$

$$-R_3 I_{I3} + (R_3 + R_4) I_{II} = E$$

$$I_{II} = \frac{E + R_3 I_{I3}}{2R} = \frac{24 + 12 \cdot 6}{2 \cdot 12}$$

$$I_{II} = 4A \Rightarrow I_{I4} = I_{II} = 4A$$

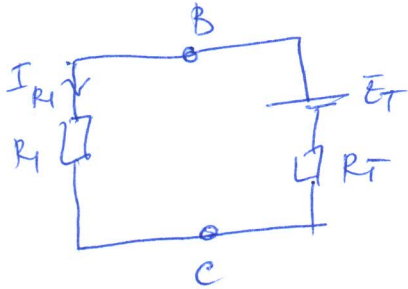
$$E_T = U_{BC}^0 = R_4 I_{I4} + R_2 I_{II} = 120V$$



$$\Rightarrow R_T = R_{BC} = (R_4 \parallel R_3) + R_2$$

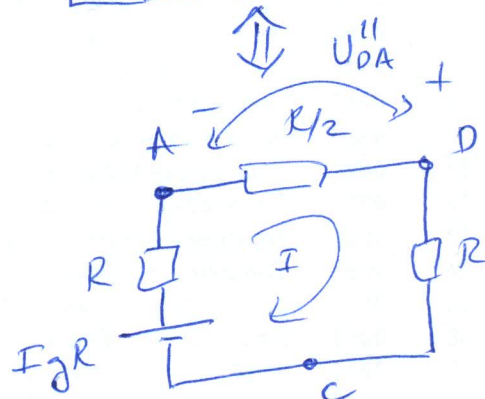
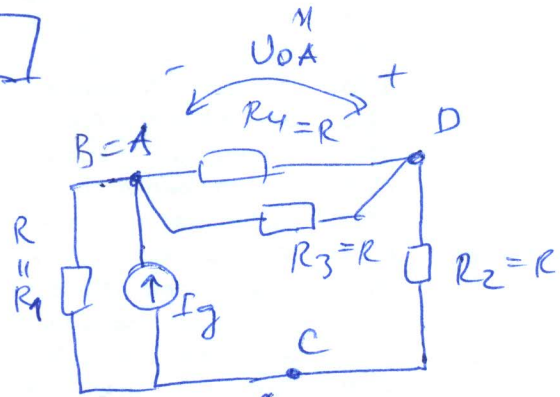
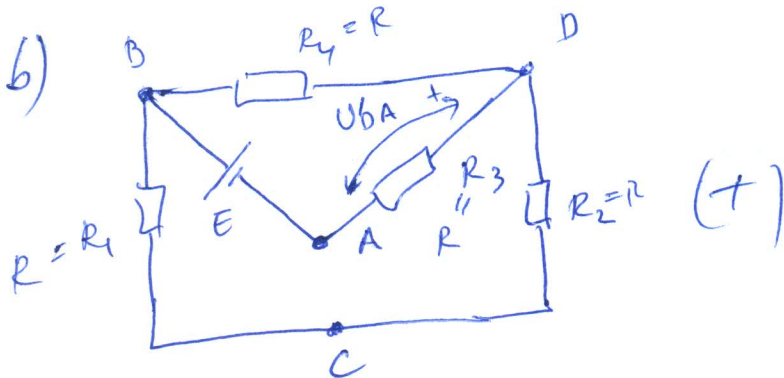
$$R_T = R/2 + R = \frac{3}{2}R = \frac{3}{2} \cdot 12 = 18 \Omega$$

$$\boxed{R_T = 18 \Omega}$$



$$I_{R1} = \frac{E_T}{R_1 + R_T} = \frac{120}{12 + 18} = \frac{120}{30}$$

$$\boxed{I_{R1} = 4A}$$

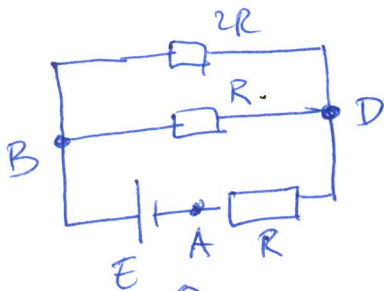


$$I = \frac{I_g R}{R + R/2 + R} = \frac{I_g R}{5R/2}$$

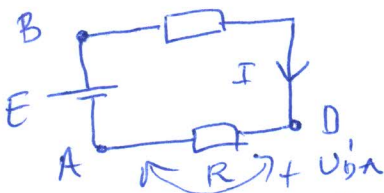
$$I_g = \frac{2I_g}{5}$$

$$U_{DA}'' = -\frac{R}{2} \cdot I = -\frac{RI_g}{5}$$

$$U_{DA}'' = -\frac{12 \cdot 6}{5} = -\frac{72}{5}$$



$$R \parallel 2R = \frac{2R}{3}$$



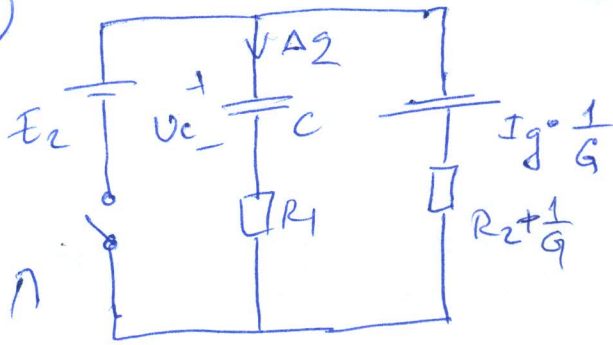
$$I = \frac{E}{R + \frac{2R}{3}} = \frac{3E}{5R}$$

$$U_{DA}^1 = RI = \frac{3E}{5} = \frac{3 \cdot 24}{5} = \frac{72}{5}$$

$$U_{DA} = U_{DA}^1 + U_{DA}''$$

$$\boxed{U_{DA} = \frac{72}{5} - \frac{72}{5} = 0V}$$

3



$$I = \frac{E_2 + I_g/G}{R_2 + \frac{1}{G}} = \dots$$

$$U_C^{(1)} = R_1 \cdot 0 + E_2 = E_2$$

$$U_C^{(2)} = 5V$$

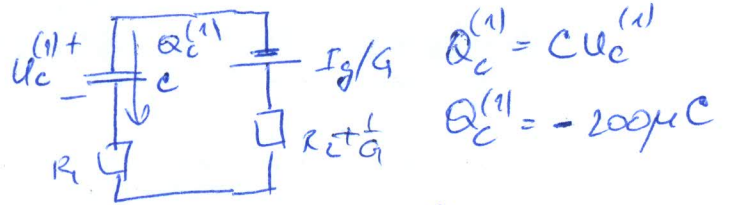
$$Q_C^{(2)} = C U_C^{(2)} = 100 \mu C$$

$$\Delta Q = Q_C^{(2)} - Q_C^{(1)} = 100 \mu C - (-200 \mu C) = 300 \mu C$$

$$\boxed{\Delta Q = 300 \mu C}$$

1)  $\Omega = OFF$   $\downarrow \Omega$

$$U_C^{(1)} = -I_g/G = -\frac{1}{0,1} = -10V$$



2)  $\Omega = ON$   $\rightarrow \Omega$

