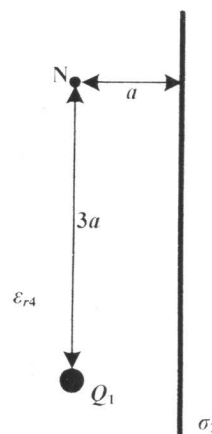


GRUPA 4

1. Tačkasto naelektrisanje $Q_1 = Q > 0$ i veoma velika, ravnomerno naelektrisana površ, površinske gustine naelektrisanja $\sigma_2 = -\sigma < 0$ nalaze se u dielektriku relativne dielektrične konstante ϵ_{r4} kao na Slici 1.

- Odrediti i **skicirati** vektor elektičnog polja u tački N. (3 poena)
- Odrediti i **skicirati** vektor sile kojom površ deluje na tačkasto naelektrisanje. (2 poena)

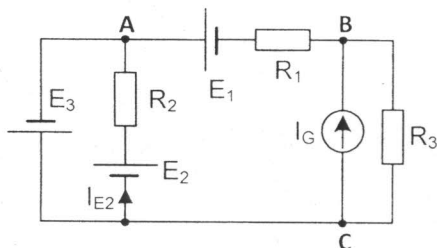


Slika 1

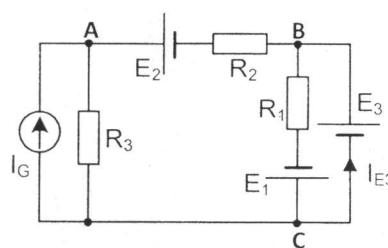
2. U kolu na Slici 2 poznato je: $E_1 = 6 \text{ V}$, $E_2 = 2 \text{ V}$, $E_3 = 10 \text{ V}$, $I_g = 2 \text{ A}$,

$R_1 = R_2 = R_3 = 4 \Omega$. Odrediti struju I_{E2} , napon U_{BC} , snagu naponskog generatora E_2 i snagu strujnog generatora I_G primenom metode

konturnih struja ili metode **napona između čvorova** (10 poena).



Slika 2

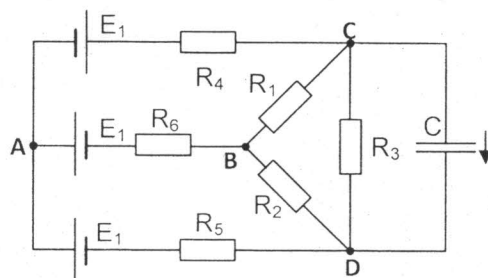


Slika 3

3. U kolu na Slici 3, primenom **Tevenenove teoreme** odrediti struju I_{E3} . Poznato je: $E_1 = 15 \text{ V}$, $E_2 = 10 \text{ V}$, $E_3 = 20 \text{ V}$, $I_g = 2 \text{ A}$, $R_1 = R_2 = R_3 = 10 \Omega$ (10 poena).

4. U kolu prikazanom na Slici 4 poznato je: $R_1 = R_2 = R_3 = 18 \Omega$, $R_4 = R_5 = R_6 = 3 \Omega$, $C = 10 \text{ nF}$, $E_1 = 18 \text{ V}$.

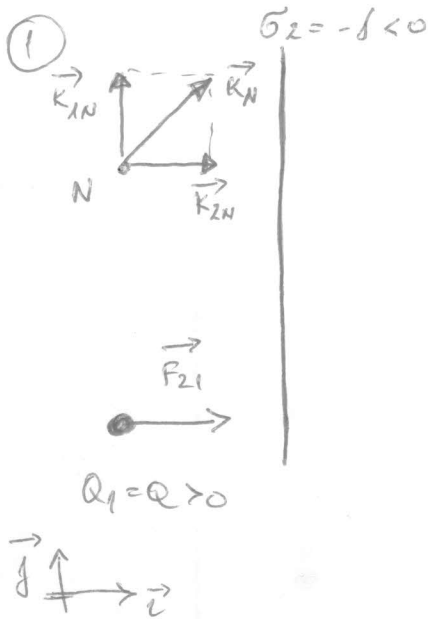
- Odrediti naelektrisanje Q kondenzatora C u skladu sa referentnim smerom naznačenim na slici (7 poena).
- Odrediti elektrostatičku energiju W_C i električno polje K u dielektriku kondenzatora, ako je C pločasti kondenzator površine ploča $S = 100 \text{ cm}^2$ i rastojanja između ploča $d = 0.01 \text{ mm}$ (3 poena)



Slika 4

Izrada kolokvijuma traje 90 minuta. Na vežbanci napisati broj grupe zadataka. Papir sa tekstom zadataka predaje se u vežbanci tj. ne sme se izneti.

GRUPA 4

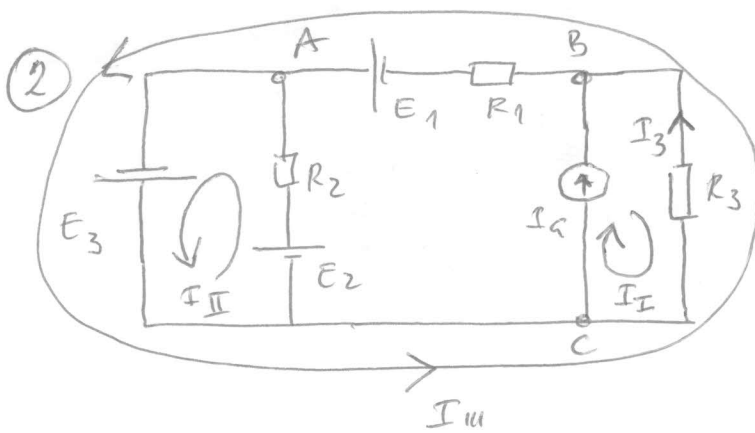


a) $\vec{K}_{1N} = \frac{Q_1}{4\pi\epsilon_0\epsilon_r r^2} \vec{j} = \frac{Q}{36\pi\epsilon_0\epsilon_r a^2} \vec{j}$

$\vec{K}_{2N} = \frac{\sigma_2}{2\epsilon_0\epsilon_r} (-\vec{i}) = \frac{\sigma}{2\epsilon_0\epsilon_r} \vec{i}$

$\vec{K}_N = \vec{K}_{1N} + \vec{K}_{2N} = \frac{Q}{36\pi\epsilon_0\epsilon_r a^2} \vec{j} + \frac{\sigma}{2\epsilon_0\epsilon_r} \vec{i} \quad [\frac{V}{m}]$

b) $\vec{F}_{21} = \frac{\sigma Q}{2\epsilon_0\epsilon_r} \vec{i} \quad [N]$



I) $I_I = I_g = 2A$

II) $0 \cdot I_I + R_2 I_{II} + 0 \cdot I_{III} = E_2 + E_3$

III) $-R_3 I_I + 0 \cdot I_{II} + (R_1 + R_3) I_{III} = E_1 + E_3$

II) $4 I_{II} = 12 \Rightarrow I_{II} = 3A$

III) $-4 \cdot 2 + 8 I_{III} = 16 \Rightarrow I_{III} = \frac{24}{8} = 3A$

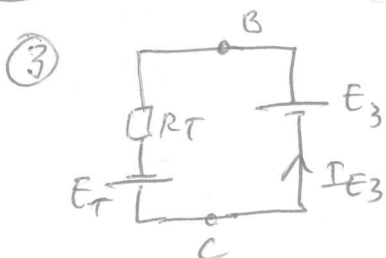
$I_{E2} = I_{II} = 3A$

$U_{BC} = -R_3 I_3 = -R_3 (I_{III} - I_{II}) = -4(3 - 2) = -4V$

$U_{BC} = -4V$

$P_{E2} = E_2 I_{E2} = 6W$

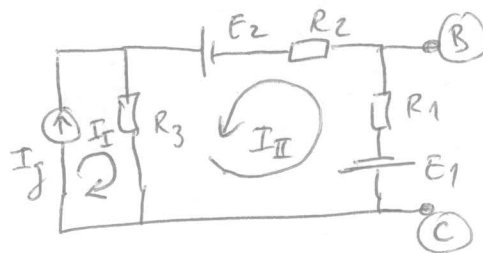
$P_{I_g} = U_{BC} I_g = -8W$



$I_{E3} = \frac{E_T + E_3}{R_T}$

$I_{E3} = \frac{+20/3 + 20}{20/3}$

$I_{E3} = 4A$



$I_I = I_g = 2A$

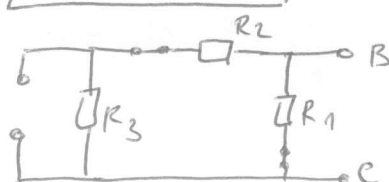
$R_3 I_I + (R_1 + R_2 + R_3) I_{II} = E_2 - E_1$

$20 + 30 I_{II} = -5$

$I_{II} = -5/6 A$

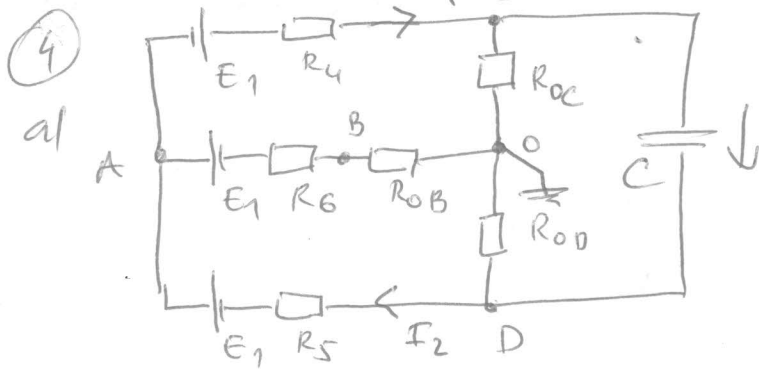
$E_T = U_{CB}^{ov} = E_1 + R_1 I_{II} = 15 - 10 \cdot \sqrt{6} = +20/3 V$

$E_T = +20/3 V$



$R_T = R_{BC} = (R_2 + R_3) \parallel R_1$

$R_T = \frac{R_1(R_2 + R_3)}{R_1 + R_2 + R_3} = \frac{20}{3} \Omega$



$$R_1 = R_2 = R_3 \Rightarrow R_{0C} = R_{0D} = R_{0B} = \frac{R_1}{3} = 6 \Omega$$

$$U_{C0} = R_{0C} I_1 + R_{0D} I_2 = 24 \text{ V}$$

$$Q_c = C U_{C0} = 240 \mu\text{F}$$

b)

$$W_c = \frac{1}{2} Q_c U_{C0} = 2,88 \mu\text{J}$$

$$k = \frac{U_{C0}}{d} = \frac{24}{10^{-5}} = 2,4 \frac{\text{MV}}{\text{m}}$$

$$G_{11} U_{A0} = \frac{\Sigma I}{A}$$

$$\left(\frac{1}{R_4 + R_{0C}} + \frac{1}{R_6 + R_{0B}} + \frac{1}{R_5 + R_{0D}} \right) U_{A0} =$$

$$= - \frac{E_1}{R_4 + R_{0C}} + \frac{E_1}{R_6 + R_{0B}} + \frac{E_1}{R_5 + R_{0D}}$$

$$\frac{3}{9} U_{A0} = + \frac{18}{9} \Rightarrow \boxed{U_{A0} = 6 \text{ V}}$$

$$U_{A0} = -E_1 + R_4 I_1 + R_{0C} I_1$$

$$I_1 = \frac{U_{A0} + E_1}{R_4 + R_{0C}} = \frac{24}{9} = \frac{8}{3} \text{ A}$$

$$U_{A0} = E_1 - R_5 I_2 - R_{0D} I_2$$

$$I_2 = \frac{E_1 - U_{A0}}{R_5 + R_{0D}} = \frac{12}{9} = \frac{4}{3} \text{ A}$$