



Ponedeljak, 20.12.2021.
Sreda, 22.12.2021.

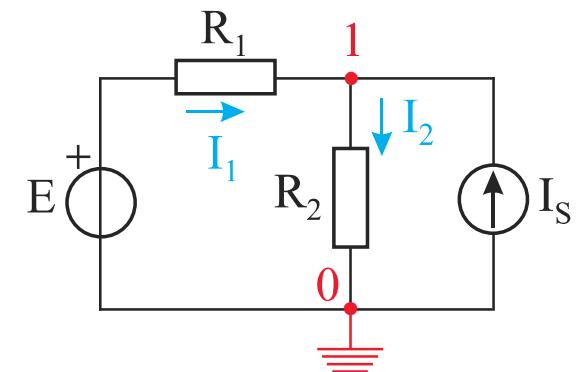
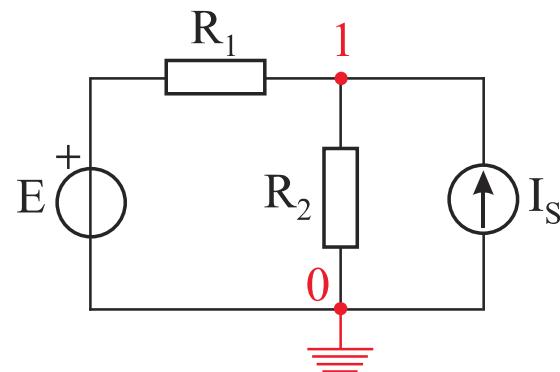
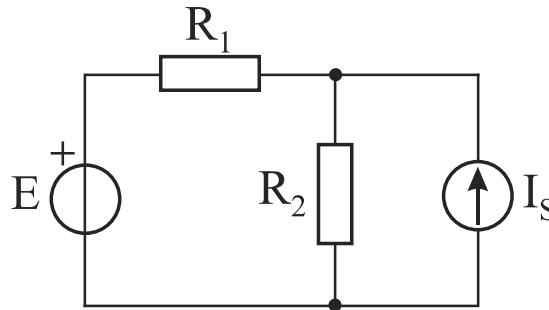
Vežbe 21

Vremenski konstantne
električne struje

Zadatak 1. U kolu sa slike odrediti snagu na otporniku R_2 .

Poznato je:

$$R_1 = 5 \Omega, R_2 = 6 \Omega, E = 10 \text{ V}, I_S = 2 \text{ A}$$



$$1. \text{ način:} \quad -I_1 + I_2 - I_S = 0$$

$$-\frac{0 - V_1 + E}{R_1} + \frac{V_1 - 0}{R_2} - I_S = 0$$

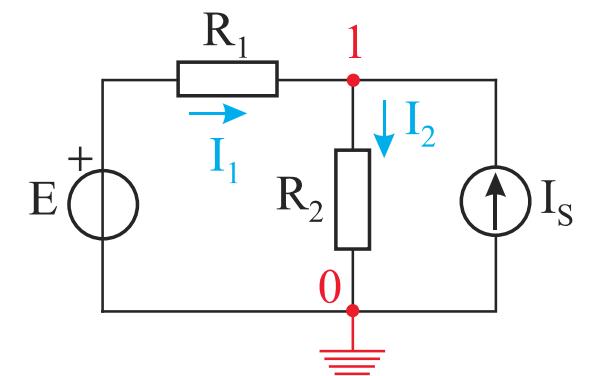
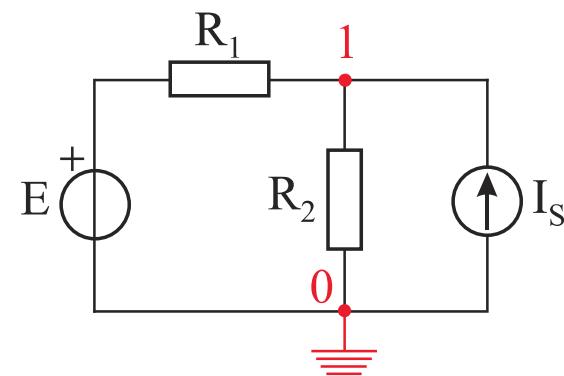
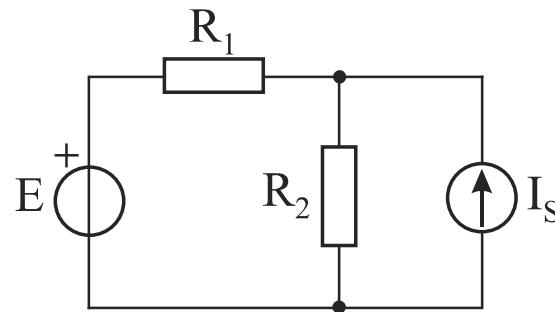
$$-\frac{-V_1 + 10}{5} + \frac{V_1}{6} - 2 = 0 \quad / \cdot 30$$

$$-6 \cdot (-V_1 + 10) + 5 \cdot V_1 - 60 = 0 \quad 11 \cdot V_1 = 120$$

$$V_1 = 10,91 \text{ V}$$

$$P_{R2} = \frac{U_{R2}^2}{R_2} = \frac{(V_1 - V_0)^2}{R_2} = \frac{V_1^2}{R_2} = \frac{10,91^2}{6}$$

$$P_{R2} = 19,83 \text{ W}$$



2. način:

$$-\frac{0 - V_1 + E}{R_1} + \frac{V_1 - 0}{R_2} - I_S = 0$$

$$V_1 \cdot \left(\frac{1}{R_1} + \frac{1}{R_2} \right) = +I_S + \frac{E}{R_1}$$

$$V_1 = 10,91 \text{ V}$$

$$P_{R2} = \frac{U_{R2}^2}{R_2}$$

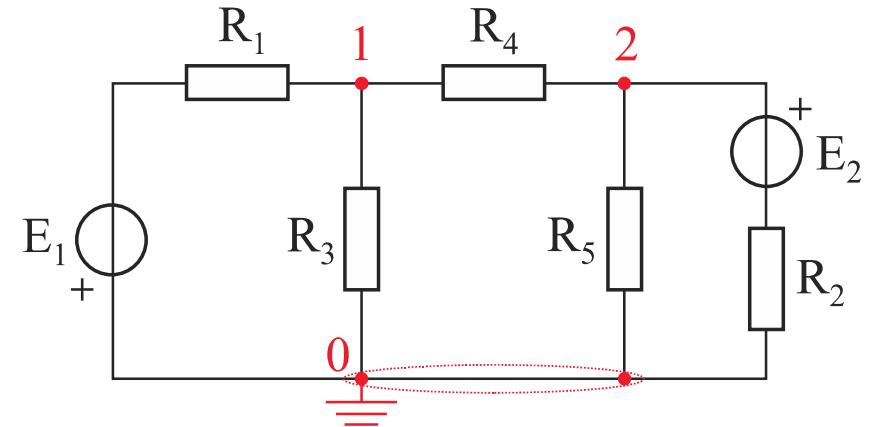
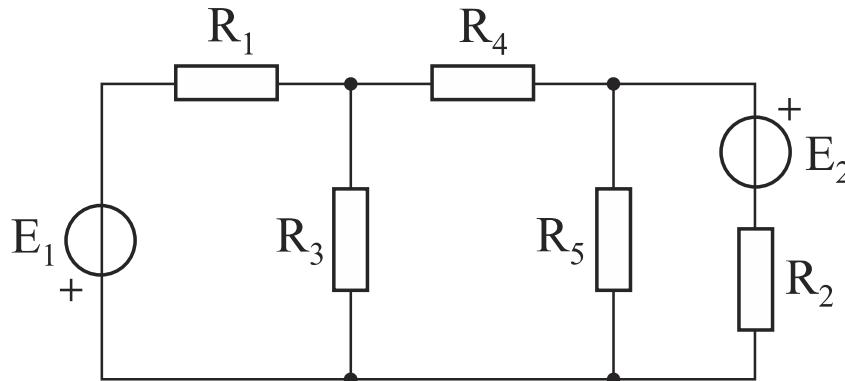
$$P_{R2} = 19,83 \text{ W}$$

Zadatak 2. U električnom kolu prikazanom na slici odrediti:

- jačine struja u svim granama kola (primenom metode potencijala čvorova), i
- snage naponskih generatora.

Brojni podaci su:

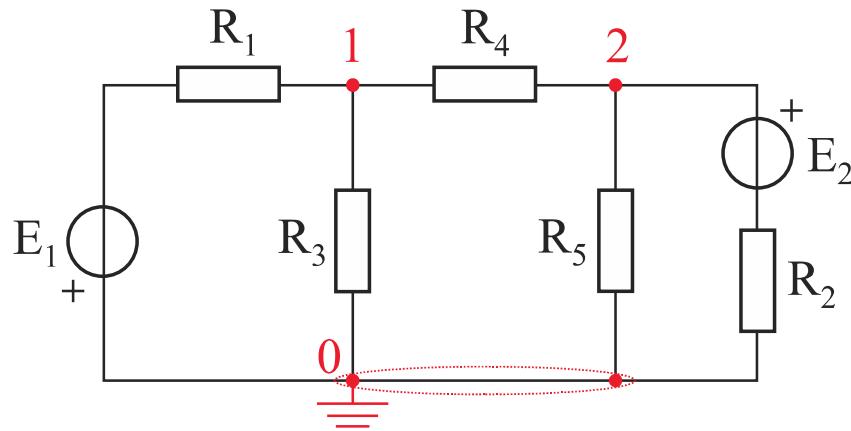
$$E_1 = 1 \text{ V}, E_2 = 2 \text{ V}, R_1 = 5 \Omega, R_2 = 10 \Omega, R_3 = 25 \Omega, R_4 = 50 \Omega, R_5 = 10 \Omega.$$



a) $\check{C}_0 : V_0 = 0 \text{ V}$

$$\check{C}_1 : V_1 \cdot \left(\frac{1}{R_1 + 0} + \frac{1}{R_3} + \frac{1}{R_4} \right) - V_2 \cdot \left(\frac{1}{R_4} \right) = -\frac{E_1}{R_1}$$

$$\check{C}_2 : V_2 \cdot \left(\frac{1}{R_2 + 0} + \frac{1}{R_4} + \frac{1}{R_5} \right) - V_1 \cdot \left(\frac{1}{R_4} \right) = \frac{E_2}{R_2}$$



$$\check{C}_0 : \quad V_0 = 0 \text{ V}$$

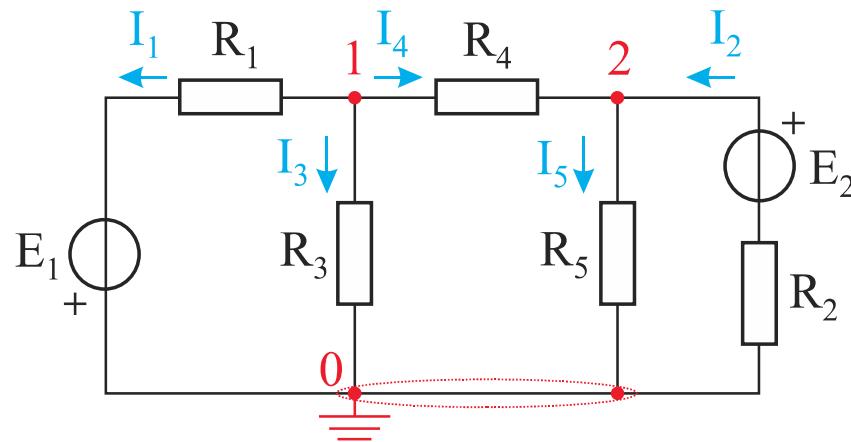
$$\check{C}_1 : \quad V_1 \cdot \left(\frac{1}{R_1 + 0} + \frac{1}{R_3} + \frac{1}{R_4} \right) - V_2 \cdot \left(\frac{1}{R_4} \right) = -\frac{E_1}{R_1}$$

$$\check{C}_2 : \quad V_2 \cdot \left(\frac{1}{R_2 + 0} + \frac{1}{R_4} + \frac{1}{R_5} \right) - V_1 \cdot \left(\frac{1}{R_4} \right) = \frac{E_2}{R_2}$$

$$V_1 \cdot \left(\frac{1}{5} + \frac{1}{25} + \frac{1}{50} \right) - V_2 \cdot \left(\frac{1}{50} \right) = -\frac{1}{5} \quad / \cdot 50$$

$$V_2 \cdot \left(\frac{1}{10} + \frac{1}{50} + \frac{1}{10} \right) - V_1 \cdot \left(\frac{1}{50} \right) = \frac{2}{10} \quad / \cdot 50$$

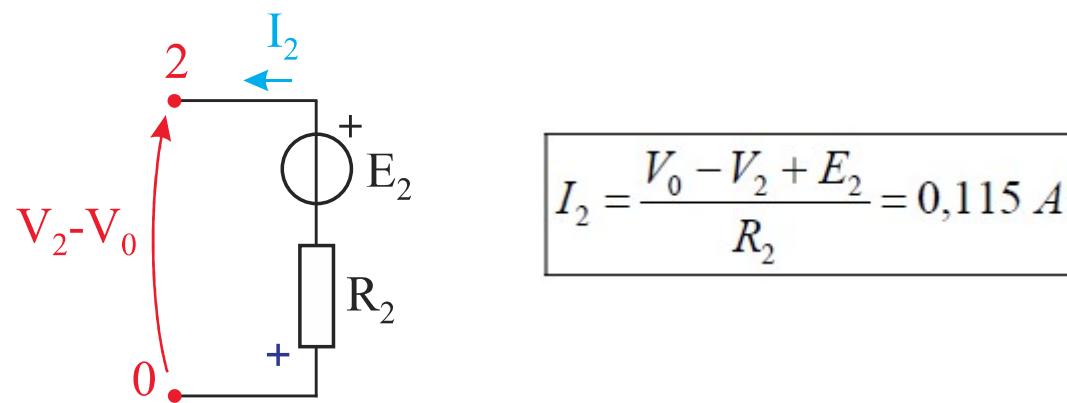
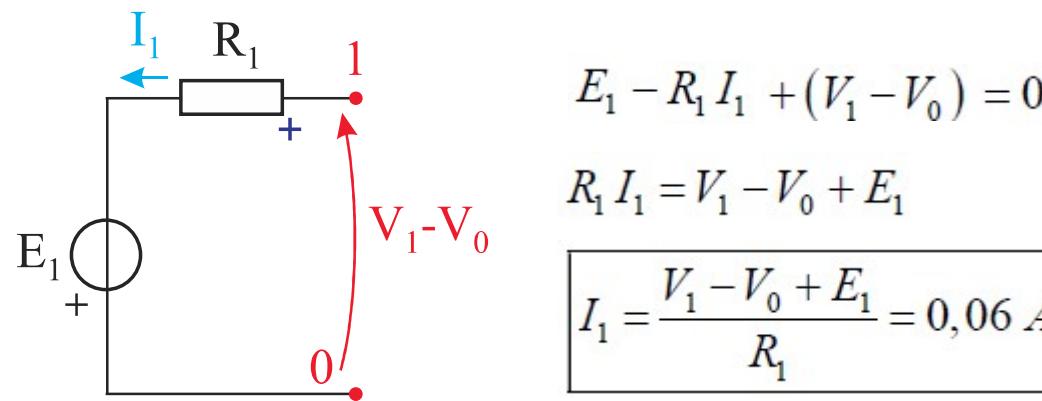
$$\begin{aligned} 13 \cdot V_1 - V_2 &= -10 \\ -V_1 + 11 \cdot V_2 &= 10 \\ \hline V_1 &= -0,7 \text{ V} \\ V_2 &= 0,85 \text{ V} \end{aligned}$$

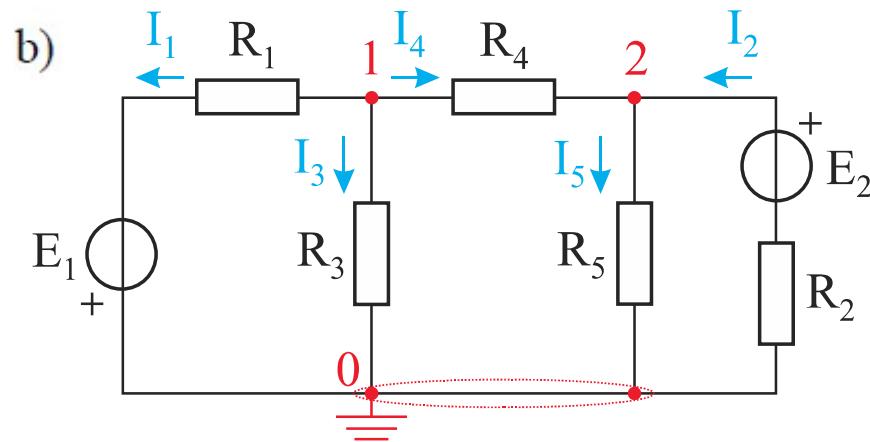


$$I_3 = \frac{V_1 - V_0}{R_3} = -0,028 \text{ A}$$

$$I_4 = \frac{V_1 - V_2}{R_4} = -0,031 \text{ A}$$

$$I_5 = \frac{V_2 - V_0}{R_5} = 0,085 \text{ A}$$





$$P_{E1} = I_1 \cdot E_1 = 0,06 \text{ W}$$

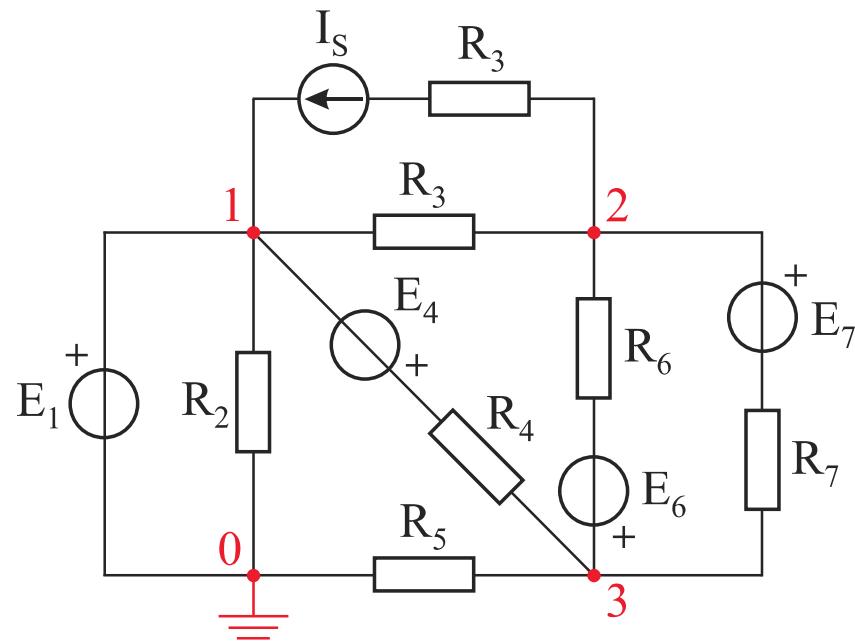
$$P_{E2} = I_2 \cdot E_2 = 0,23 \text{ W}$$

Zadatak 3. Napisati jednačine po metodi u kojoj treba koristiti manji broj jednačina. Odrediti napon U_{13} .

Poznato je:

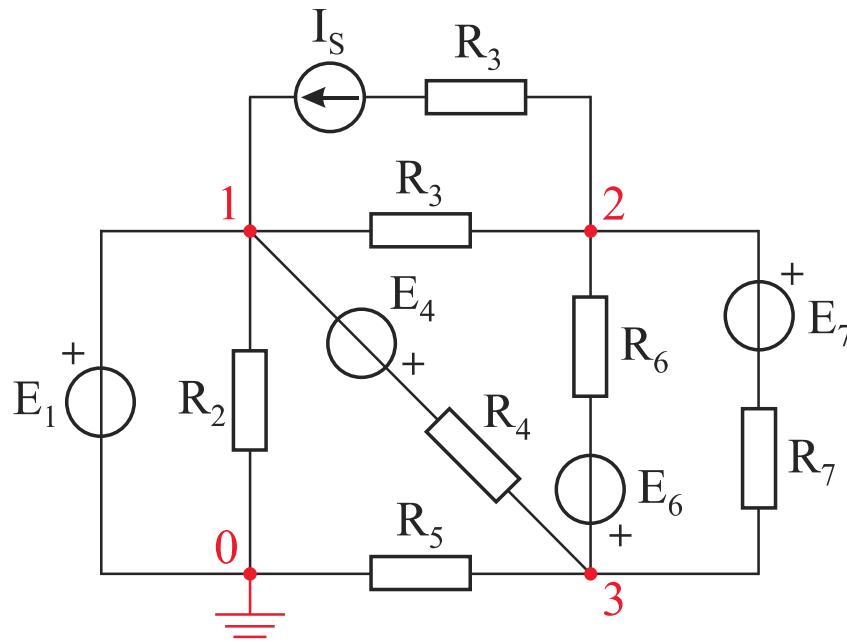
$$R_2=2 \Omega, R_3=1 \Omega, R_4=6 \Omega, R_5=3 \Omega, R_6=1 \Omega, R_7=1 \Omega,$$

$$E_1=4 \text{ V}, E_4=5 \text{ V}, E_6=5 \text{ V}, E_7=1 \text{ V}, I_S=3 \text{ A}.$$



$$MKS: \quad n_g - (n_c - 1) - n_{s.g.} = 8 - (4 - 1) - 1 = 4$$

$$MP\check{C}: \quad (n_c - 1) - n_{n.g.} = (4 - 1) - 1 = 2$$



$$\check{C}_0 : V_0 = 0 \text{ V}$$

$$\check{C}_1 : V_1 = E_1 = 4 \text{ V}$$

$$\check{C}_2 : V_2 \cdot \left(\frac{1}{R_3 + \infty}^0 + \frac{1}{R_3} + \frac{1}{R_6} + \frac{1}{R_7} \right) - V_1 \cdot \left(\frac{1}{R_3 + \infty}^0 + \frac{1}{R_3} \right) - V_3 \cdot \left(\frac{1}{R_6} + \frac{1}{R_7} \right) = -I_S - \frac{E_6}{R_6} + \frac{E_7}{R_7}$$

$$\check{C}_3 : V_3 \cdot \left(\frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6} + \frac{1}{R_7} \right) - V_1 \cdot \left(\frac{1}{R_4} \right) - V_2 \cdot \left(\frac{1}{R_6} + \frac{1}{R_7} \right) = \frac{E_4}{R_4} + \frac{E_6}{R_6} - \frac{E_7}{R_7}$$

$$3 \cdot V_2 - 2 \cdot V_3 = -3$$

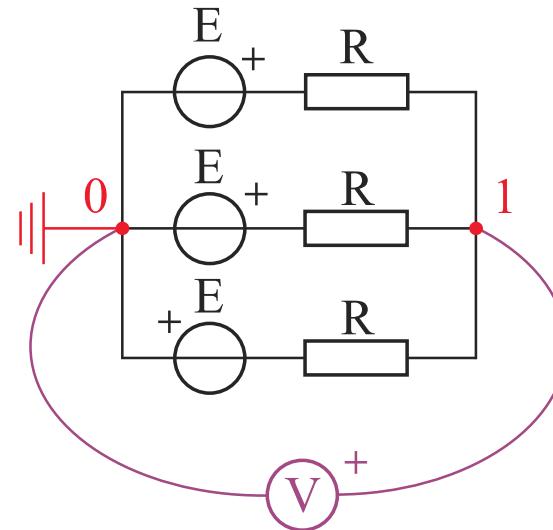
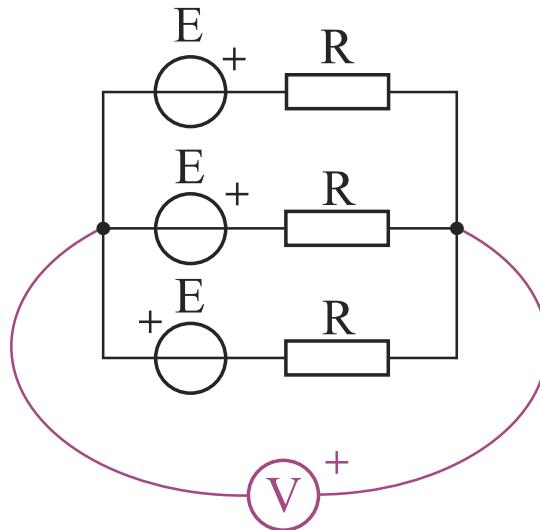
$$-12 \cdot V_2 + 15 \cdot V_3 = 33$$

$$V_2 = 1 \text{ V}$$

$$V_3 = 3 \text{ V}$$

$$U_{13} = V_1 - V_3 = 4 - 3 = 1 \text{ V}$$

Zadatak 4. Tri jednaka generatora ems $E=30 \text{ V}$ i tri jednaka otpornika otpornosti $R=100 \Omega$ vezani su u kolo kao na slici. Koliki je napon što pokazuje voltmeter, zanemarljive provodnosti, vezan između čvorova 1 i 0.



$$\check{C}_0 : \quad V_0 = 0 \text{ V}$$

$$\check{C}_1 : \quad V_1 \cdot \left(\frac{1}{R} + \frac{1}{R} + \frac{1}{R} \right) = \frac{E}{R} + \frac{E}{R} - \frac{E}{R} \quad / \cdot R$$

$$3 \cdot V_1 = E$$

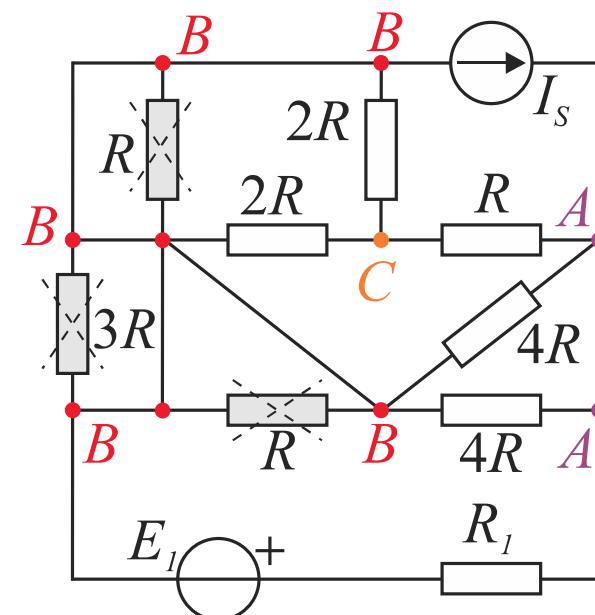
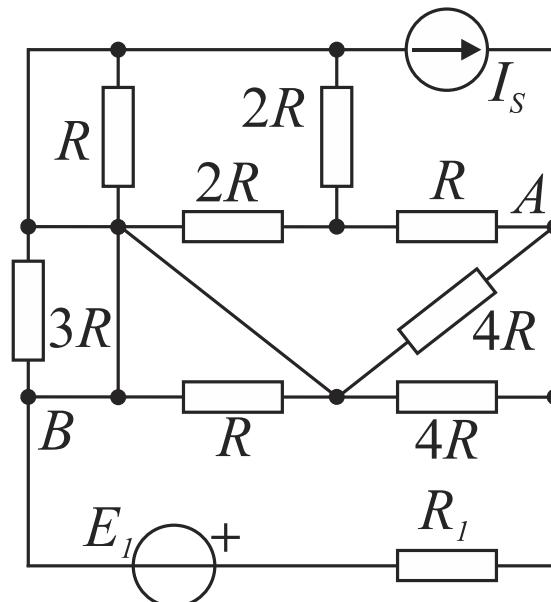
$$V_1 = \frac{E}{3} = 10 \text{ V}$$

$$U_V = U_{10} = V_1 - V_0 = 10 \text{ V}$$

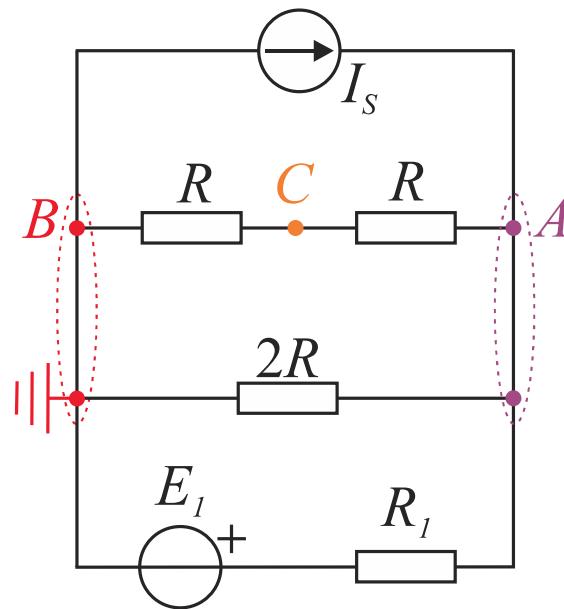
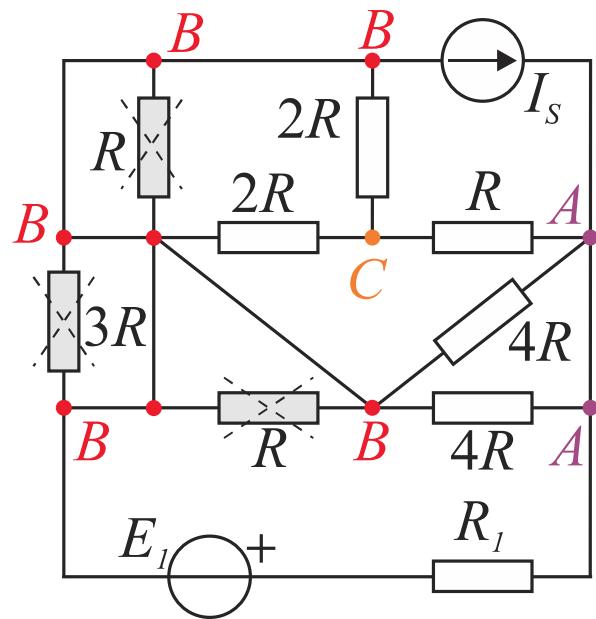
Zadatak 5. U električnom kolu prikazanom na slici, primenom metode potencijala čvorova, odrediti:

- napon između tačaka A i B, U_{AB} ,
- snage svih generatora.

Poznato je: $E_1 = 4 \text{ V}$, $I_s = 3 \text{ A}$, $R = 2 \Omega$, $R_1 = 3R$.



a)



$$V_B = 0 \text{ V}$$

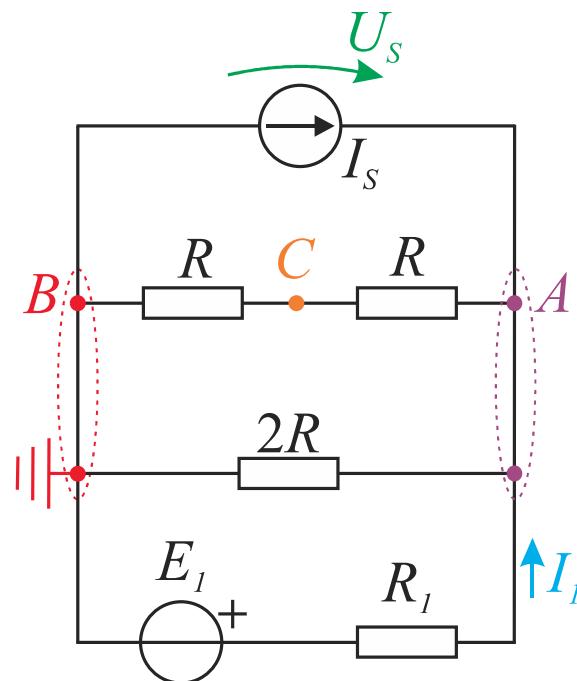
$$\frac{V_A \left(\frac{1}{\infty} + \frac{1}{R+R} + \frac{1}{2R} + \frac{1}{R_1+0} \right) = I_s + \frac{E_1}{R_1}}$$

$$\frac{V_A \left(\frac{1}{4} + \frac{1}{4} + \frac{1}{6} \right) = 3 + \frac{4}{6}}{\quad / \cdot 12}$$

$$8V_A = 44 \quad \Rightarrow \quad V_A = 5,5 \text{ V}$$

$$U_{AB} = V_A - V_B = 5,5 - 0$$

$$U_{AB} = 5,5 \text{ V}$$



$$I_1 = \frac{V_B - V_A + E_1}{R_1} = \frac{0 - 5,5 + 4}{6}$$

$$I_1 = -0,25 \text{ A}$$

$$P_{E1} = E_1 I_1 = 4 \cdot (-0,25)$$

$$P_{E1} = -1 \text{ W}$$

$$P_S = U_s I_s = (V_A - V_B) I_s = (5,5 - 0) \cdot 3$$

$$P_S = 16,5 \text{ W}$$