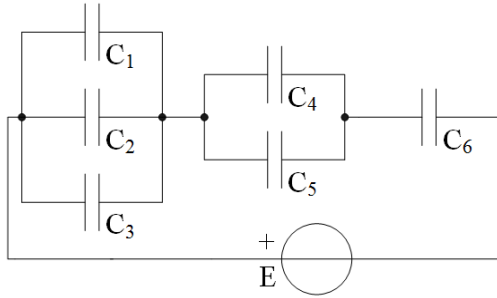


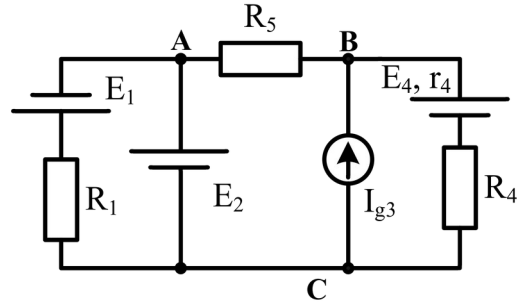
Elektrotehnika

pismeni ispit, 16.9.2025.

1. U kolu na Slici 1 poznate su kapacitivnosti $C_1=C=6\mu F$, $C_2=C_5=2C$, $C_3=C_6=3C$, $C_4=4C$ i elektromotorna sila idealnog naponskog generatora $E=15V$. Pre povezivanja, svi kondenzatori su bili neopterećeni. Odrediti naelektrisanje na C_6 , napon na C_1 i energiju kondenzatora C_2 . (8 poena)



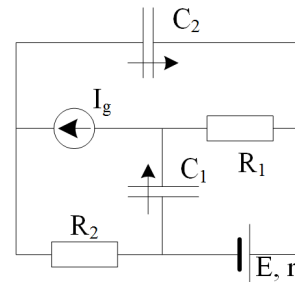
Slika 1



Slika 2

2. U kolu na Slici 2 poznate su vrednosti parametara elemenata: $R_1=20\Omega$, $R_4=R_5=10\Omega$, $E_1=20V$, $E_2=10V$, $E_4=20V$, $r_4=5\Omega$ i $I_{g3}=1A$. Primenom Tevenenove teoreme odrediti intenzitet struje generatora E_2 , a nakon toga i njegovu snagu. (12 poena)

3. Na Slici 3 poznato je $R_1=R_2=10k\Omega$, $E=20V$, $r=5k\Omega$, $I_g=1mA$ i $C_1=C_2=22nF$. Odrediti količine naelektrisanja na kondenzatorima. (8 poena)

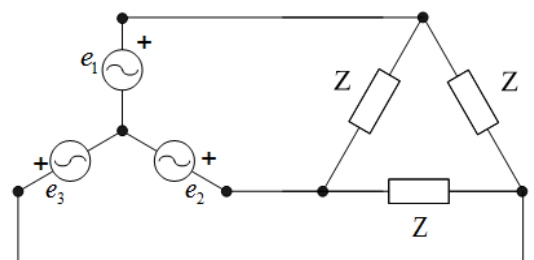


Slika 3

4. Na naponski generator $u(t)=100\cos(100t)V$ priključena je paralelna veza idealnog kalema prividne snage $S_L=1000VA$ i složenog potrošača kompleksne snage $\bar{S}=1.5+j0.5kVA$.

- Odrediti kompleksne izraze za struje u svim granama kola. (6 poena)
- Odrediti induktivnost kalema. (3 poena)
- Odrediti ukupnu aktivnu, reaktivnu i prividnu snagu paralelne veze elemenata. (3 poena)

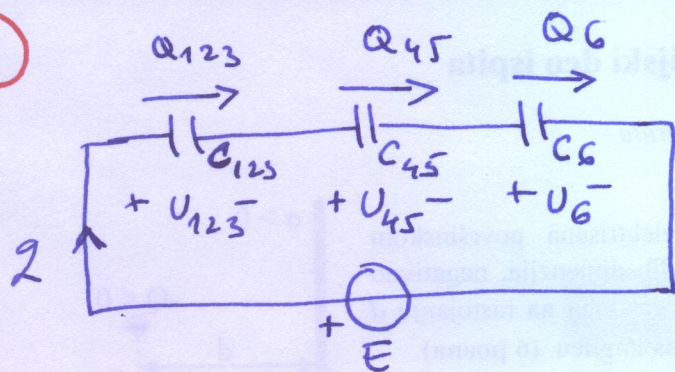
5. Na Slici 4 je prikazan trofazni sistem generator - potrošač. Ems generatora iznose:
 $e_1(t)=400\sqrt{2}\cdot\cos(314t)V$
 $e_2(t)=400\sqrt{2}\cdot\cos(314t-2\pi/3)V$
 $e_3(t)=400\sqrt{2}\cdot\cos(314t+2\pi/3)V$, dok impedansa jedne faze potrošača iznosi $\bar{Z}=80+j60\Omega$.



Slika 4

- Nacrtati fazorski dijagram linijskih napona. (3 poena)
- Odrediti efektivnu vrednost linijskih struja, prividnu i reaktivnu snagu potrošača. (7 poena)

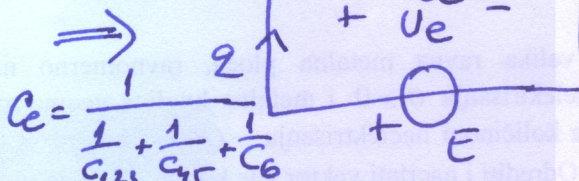
1



$$C_{123} = 6C = 36\mu F$$

$$C_{45} = 6C = 36\mu F$$

$$C_6 = 3C = 18\mu F$$



$$C_e = \frac{1}{\frac{1}{C_{123}} + \frac{1}{C_{45}} + \frac{1}{C_6}}$$

$$Q = Q_e = C_e \cdot U_e = C_e E$$

$$Q = 135\mu C$$

$$Q_{123} = Q_{45} = Q_6 = Q = 135\mu C$$

$$U_1 = U_2 = U_3 = U_{123} = \frac{Q_{123}}{C_{123}} = \frac{Q}{6C} = \frac{15}{4} = 3.75V$$

$$U_4 = U_5 = U_{45} = \frac{Q_{45}}{C_{45}} = \frac{Q}{6C} = \frac{15}{4} = 3.75V$$

$$U_6 = \frac{Q_6}{C_6} = \frac{Q}{3C} = \frac{15}{2} = 7.5V$$

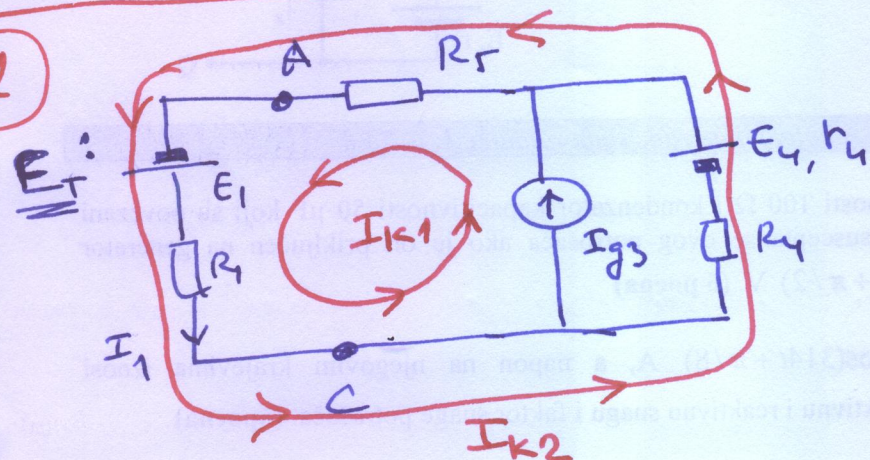
$$(E = U_{123} + U_{45} + U_6)$$

$$W_{C2} = \frac{1}{2} C_2 U_2^2$$

$$W_{C2} = \frac{1}{2} 2C \left(\frac{Q}{6C}\right)^2 = \frac{675}{8} \mu J$$

$$W_{C2} = 84.375 \mu C$$

2



$$E_T = U_{AC}^{ov} = -E_1 + R_1 I_1$$

koliko je I_1 ?

$$\underline{MKS}: I_{k1} = I_{g3} = 1A \quad (1)$$

$$R_{21} I_{k1} + R_{22} I_{k2} = \sum_{k2} E \quad (2)$$

$$\Rightarrow 30 + 45 I_{k2} = 40$$

$$R_{21} = R_1 + R_5 = 30$$

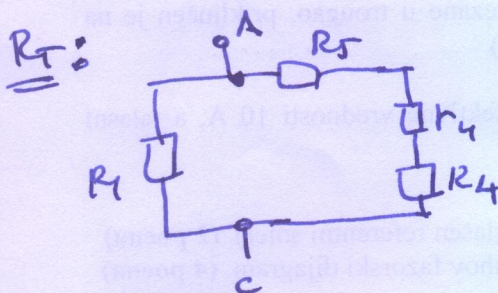
$$R_{22} = R_1 + R_4 + r_4 + R_5 = 45$$

$$\sum E = E_1 + E_2 = 40$$

$$I_{k2} = \frac{10}{45} = \frac{2}{9} A$$

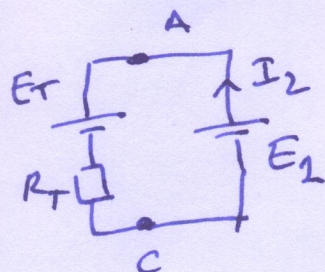
$$I_1 = I_{k1} + I_{k2} = \frac{11}{9} A$$

$$\Rightarrow E_T = -20 + 20 \cdot \frac{11}{9} = \frac{40}{9} V$$



$$R_T = R_{AC}^{ov} = R_1 \parallel (R_5 + r_4 + R_4)$$

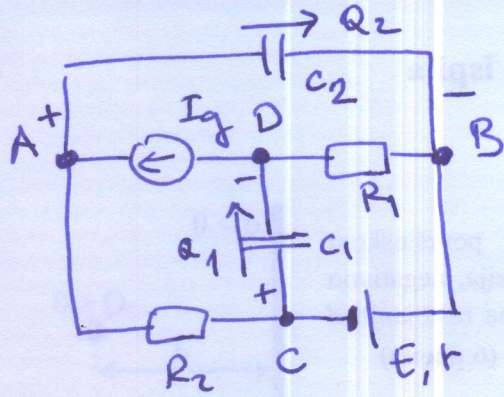
$$R_T = \frac{20 \cdot 25}{20 + 25} = \frac{100}{9} \Omega$$



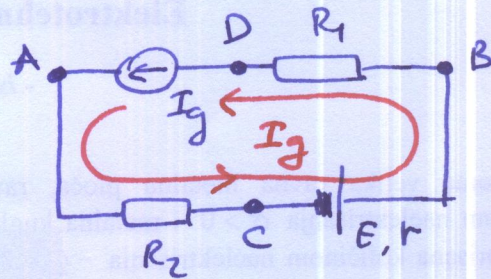
$$I_2 = \frac{E_2 - E_T}{R_T} = \frac{10 - \frac{40}{9}}{\frac{100}{9}} = \frac{1}{2} A$$

$$P_2 = E_2 I_2 = 10 \cdot \frac{1}{2} = 5W$$

3



$$I_{c1}=0 \\ \Rightarrow \\ I_{c2}=0$$



$$U_D = U_{AB} = (R_2 + r)I_g - E$$

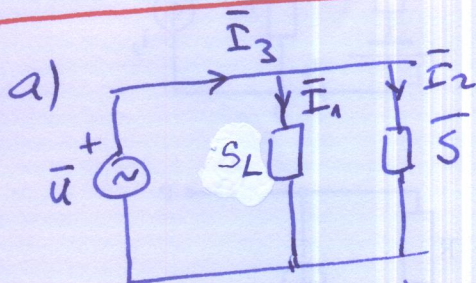
$$U_D = -5 \text{ V}$$

$$U_A = U_{CD} = (R_1 + r)I_g - E$$

$$U_A = -5 \text{ V}$$

$$Q_1 = C_1 U_1 = -110 \text{ nC} \\ Q_2 = C_2 U_2 = -110 \text{ nC}$$

4



$$\begin{aligned} \bar{S} &= \bar{U} \cdot \bar{I}^* \\ \bar{I} &= \left(\frac{\bar{S}}{\bar{U}} \right)^* \end{aligned}$$

$$S_L = 1000 \text{ VA}$$

$$\text{kalemo: } P_L = 0 \text{ W } Q_L (= S_L) = 1000 \text{ VAR}$$

$$\bar{S}_L = j1000 \text{ VA}$$

$$\bar{I}_1 = \frac{\bar{S}_L^*}{\bar{U}^*} = \frac{-j1000}{\frac{100}{\sqrt{2}}} = -j10\sqrt{2} \text{ A}$$

$$\bar{S} = (1500 + j1500) \text{ VA}$$

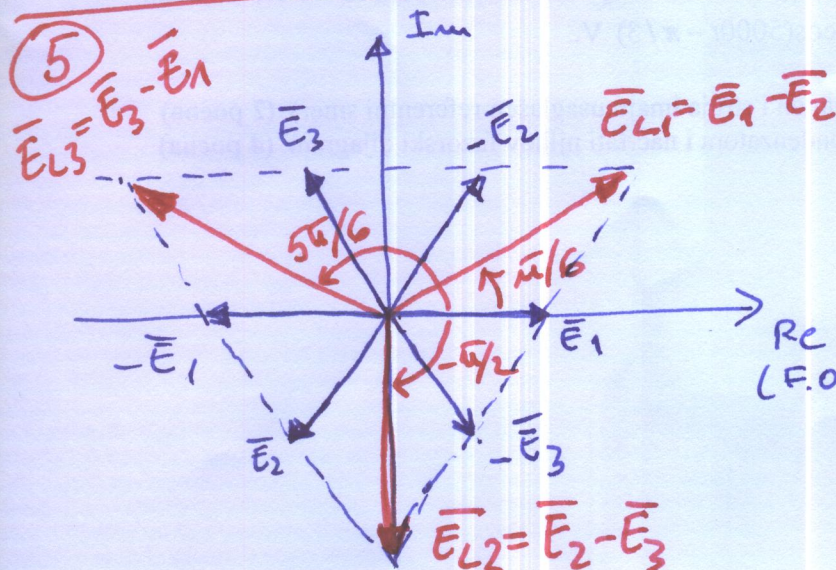
$$\bar{I}_2 = \frac{\bar{S}^*}{\bar{U}^*} = \frac{1500 - j1500}{\frac{100}{\sqrt{2}}} = (15\sqrt{2} - j15\sqrt{2}) \text{ A}$$

$$\bar{I}_3 = \bar{I}_1 + \bar{I}_2 = (15\sqrt{2} - j5\sqrt{2}) \text{ A}$$

$$b) \quad Z_L = \omega L = \frac{U}{I_1} \Rightarrow L = \frac{U}{\omega I_1} = \frac{\frac{100}{\sqrt{2}}}{100 \cdot 10\sqrt{2}} = \frac{1}{20} = 50 \text{ mH}$$

$$c) \quad \bar{S}_{uk} = \bar{S}_L + \bar{S} = (1500 + j1500) \text{ VA} \Rightarrow \begin{aligned} P_{uk} &= 1500 \text{ W} \\ Q_{uk} &= 1500 \text{ VAR} \\ S_{uk} &= 1500\sqrt{2} \text{ VA} \end{aligned}$$

5



$$U_{Fgen} = 400 \text{ V}$$

$$U_L = U_{Fgen} \sqrt{3} = 400\sqrt{3} \text{ V (Y)}$$

$$U_{Fpot.} = U_L (\Delta)$$

$$U_{Fpot} = 400\sqrt{3} \text{ V}$$

$$I_{Fpot} = \frac{U_{Fpot}}{Z} = \frac{400\sqrt{3}}{100} = 4\sqrt{3} \text{ A}$$

$$Z = \sqrt{80^2 + 60^2} = 20\sqrt{4^2 + 3^2} = 100 \Omega$$

$$I_L = \sqrt{3} I_{Fpot} (\Delta)$$

$$I_L = 12 \text{ A}$$

$$S = 3 I_{Fpot}^2 = 14400 \text{ VA}, Q = 3 \times I_{Fpot}^2 = 8640 \text{ VAR}$$