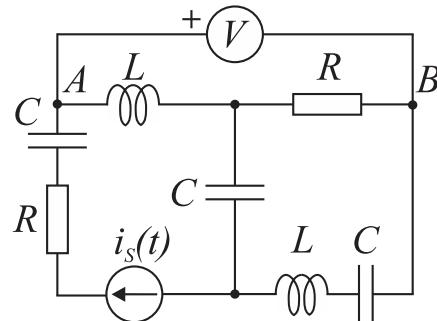


ZADACI

Zadatak 1. U električnom kolu sa slike odrediti:

- pokazivanje idealnog voltmetra,
- kompleksnu snagu strujnog generatora.

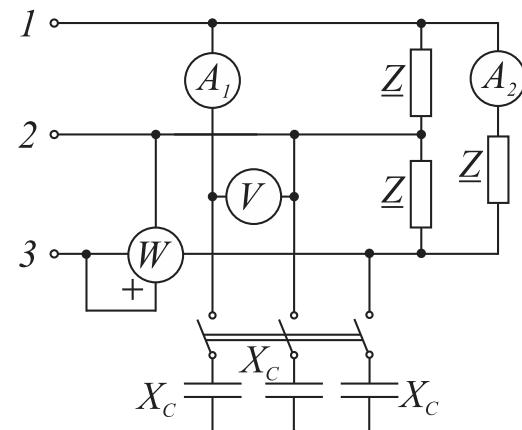
Poznato je: $i_s(t) = 10\sqrt{2} \cos(1000t + \pi/2) \text{ A}$, $R = 20 \Omega$,
 $L = 20 \text{ mH}$, $C = 50 \mu\text{F}$.



Slika 1.

Zadatak 2. Faktor snage trofaznog, simetričnog, pretežno induktivnog prijemnika sa slike je 0,86, a moduo impedanse $Z = 20 \Omega$. Prijemnik je priključen na simetričnu trofaznu mrežu, faznog napona prve faze $U_1 = 220 \text{ V}$.

- Izračunati reaktanse kondenzatora kojima se faktor snage grupe povećava na jedinicu.
- Odrediti pokazivanje idealnih mernih instrumenata pre i posle priključenja kondenzatora.
- Skicirati fazorski dijagram faznih napona mreže i fazora svih veličina od kojih zavise pokazivanja instrumenata izračunata pod b).



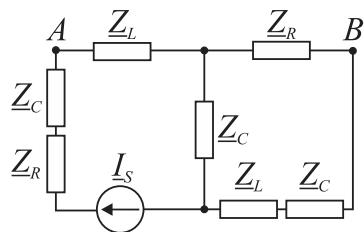
Slika 2.

PRAVILA POLAGANJA

Za položen kolokvijum neophodno je sakupiti više od 50% od ukupnog broja poena na zadacima. Svaki zadatak se boduje sa 25 poena. Kolokvijum traje jedan sat i trideset minuta.

K2 Z1

a)



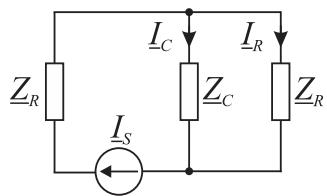
$$\underline{Z}_R = R = 20 \Omega$$

$$\underline{Z}_L = j\omega L = j20 \Omega$$

$$\underline{Z}_C = -j(1/\omega C) = -j 20 \Omega$$

$$I_S = 10 e^{j\pi/2} = j10 A$$

$$\underline{Z}_e = \underline{Z}_L + \underline{Z}_C = j20 - j20 = 0$$



$$\begin{aligned} I_R &= \frac{\underline{Z}_C}{\underline{Z}_C + \underline{Z}_R} I_S = \frac{-j20}{-j20 + 20} j10 = \frac{-j}{1-j} j10 \\ &= \frac{10}{1-j} \frac{1+j}{1+j} = \frac{10 + j10}{2} = (5 + j5) A \end{aligned}$$

$$\underline{U}_{AB} = \underline{Z}_L \underline{I}_S + \underline{Z}_R \underline{I}_R = j20 j10 + 20(5 + j5) = (-100 + j100) V$$

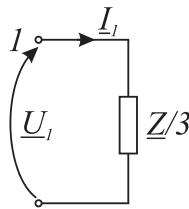
$$U_V = |\underline{U}_{AB}| = \sqrt{(-100)^2 + 100^2} = 100\sqrt{2} V$$

b)

$$\begin{aligned} \underline{S}_S &= \underline{U}_S \underline{I}_S^* \\ &= [\underline{Z}_R \underline{I}_S + \underline{Z}_R \underline{I}_R] \underline{I}_S^* = \underline{Z}_R [\underline{I}_S + \underline{I}_R] \underline{I}_S^* \\ &= 20 [j10 + 5 + j5] (-j10) = (3000 - j1000) VA. \end{aligned}$$

K2 Z2

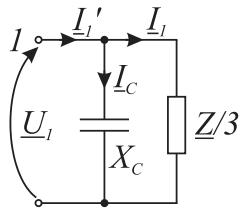
a)



$$\varphi = \arccos 0,86 = 30,68^\circ$$

$$\underline{Z} = Z e^{+j\varphi} = 20 e^{+j30,68^\circ} \Omega$$

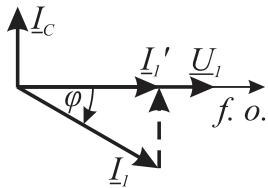
$$I_1 = \frac{\underline{U}_1}{\underline{Z}/3} = \frac{3 \cdot 220}{20 e^{+j30,68^\circ}} = 33 e^{-j30,68^\circ} A$$



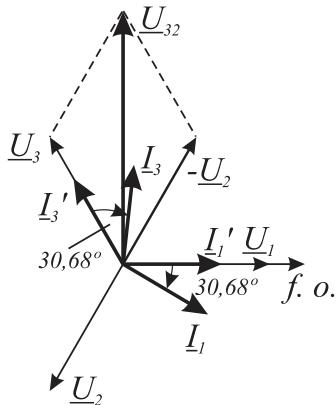
$$I_C = I_1 \sin \varphi$$

$$\frac{\underline{U}_1}{X_C} = \frac{\underline{U}_1}{Z/3} \sin \varphi \Rightarrow \frac{1}{X_C} = \frac{3 \sin \varphi}{Z} \Rightarrow X_C = \frac{Z}{3 \sin \varphi} = 13,05 \Omega$$

$$I_1' = I_1 \cos \varphi = 28,38 A$$



b)



$$P_{W_{pre}} = \operatorname{Re} \left\{ \underline{U}_{32} \underline{I}_3^* \right\} = U_{32} I_3 \cos \angle (\underline{U}_{32}, \underline{I}_3) \\ = \sqrt{3} U_1 I_1 \cos(30^\circ - 30,68^\circ) \\ = \sqrt{3} \cdot 220 \cdot 33 \cdot \cos(-0,68^\circ) = 12,574 kW$$

$$P_{W_{poste}} = \operatorname{Re} \left\{ \underline{U}_{32} \underline{I}_3^* \right\} = U_{32} I_3' \cos \angle (\underline{U}_{32}, \underline{I}_3') \\ = \sqrt{3} U_1 I_1' \cos 30^\circ = \sqrt{3} \cdot 220 \cdot 28,38 \cdot \cos 30^\circ = 9,35 kW$$

$$U_{V_{pre}} = |\underline{U}_{12}| = \sqrt{3} U_1 = \sqrt{3} \cdot 220 = 311,13 V$$

$$U_{V_{poste}} = U_{V_{pre}} = 311,13 V$$

$$I_{A1,pre} = 0 A$$

$$I_{A1,poste} = |\underline{I}_C| = \frac{\underline{U}_1}{X_C} = \frac{220}{13,05} = 16,86 A$$

$$I_{A2,pre} = \frac{|\underline{I}_1|}{\sqrt{3}} = \frac{33}{\sqrt{3}} = 19,05 A$$

$$I_{A2,poste} = I_{A2,pre} = 19,05 A$$